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ENCHYTRÆIDÆ OF THE WEST COAST OF NORTH AMERICA

BY

GUSTAV EISEN

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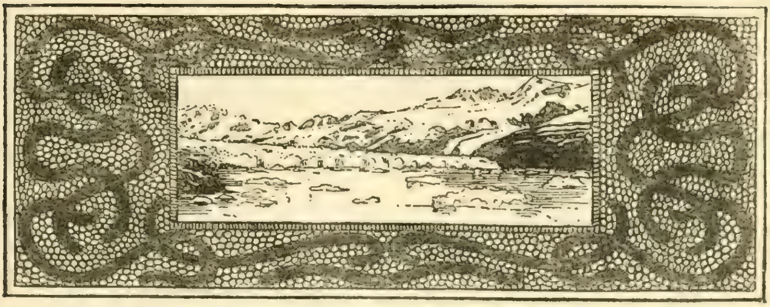

ENCHYTRÆIDÆ OF THE WEST COAST OF NORTH AMERICA

BY GUSTAV EISEN

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INTRODUCTION

THE following paper is based principally on the Enchytræidæ collected by the Harriman Expedition to Alaska in 1899. The specimens were placed at my disposal for study by Prof. W. E. Ritter, of the University of California, and by Prof. Trevor Kincaid, of the University of Washington. At the time these specimens were sent me, I was already working up a collection of Enchytræidæ previously obtained in Alaska by Prof. Trevor Kincaid and Prof. W. A. Setchell, the latter principally on the island of Unalaska. Other specimens had been received from Dr. Richard C. McGregor, of San Francisco, and still others had been collected by myself. Another small collection had long been in my possession, having been brought together by Dr. Anton Stuxberg during the Vega Expedition under Baron A. E. Nordenskiöld in 1877. Of the

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latter only those species collected in Alaska are described in this paper. With the permission of Mr. E. H. Harriman I have included descriptions of all the above collections in the present paper, which thus becomes much more valuable and exhaustive.

The number of species found within a really limited territory will probably prove a surprise to students of this group of animals; and it must be remembered that none of those who contributed the collections made a specialty of this group. A few specimens were collected here and others there, every collector having some other special branch to look after. Still the result is most gratifying, as the forty six new species increase the total from 128 to 174. While the specimens from Alaska have all been carefully gone over and all the species described, the same cannot be said of other specimens in my collection. Owing to unforeseen circumstances this paper had to be brought to a speedy close and many species had to be left out which undoubtedly would have proved to be new. I have yet in my possession some fifty or more new species collected on the Pacific Coasts by myself, and by Dr. Stuxberg during the Vega Expedition, but time does not allow me to describe them now. My object in mentioning this fact is merely to show the great number of species on the Pacific coast and in the arctic and subarctic zones generally. Nearly every new locality is found to possess new and distinct species, which seem to be much more restricted in their habitat than is the case in Europe. The isolation of species in California is undoubtedly due to the lesser rainfall on this part of the coast, which has prevented the species from rapidly spreading. In the north, along the Alaska coast, Enchytræidæ seem to occur in countless numbers, favorable localities being found everywhere. But the further south we go the scarcer become the species and the higher must we go in the mountains in order to find any at all. Compared with the north, Enchytræidæ in California are exceedingly scarce, and even during the rainy season we may hunt for several days in apparently favorable localities without finding any. Even in the Sierra Nevada species of this family are comparatively rare. As we go further south, into Mexico, the species become still more scarce, and those of *Mesenchytræus* seem to disappear altogether.

San Francisco,
March 31, 1900.

Note.—This paper was finished and forwarded to the editor a month or so before the publication of the 'Oligochæta' by Dr. W. Michaelsen. Being unable to use the admirable work of Dr. Michaelsen in the preparation of my paper, I was obliged to postpone until proof-reading some important and necessary changes in the nomenclature of genera, species and organs. These changes I have now made. Thus I have followed Dr. Michaelsen in changing *Pachydrilus* to *Lumbricillus*, and I have also adopted such terms as 'ampulla,' 'peptonephridia' and others in order to make the terminology more uniform. Since Dr. Michaelsen's Oligochæta was published a few minor publications by other investigators have appeared, containing descriptions of species of Enchytræidæ, especially from the southern part of Europe and the Alps. These species I have as a rule left without consideration, the time being too limited to enable me to make further additions and comparisons.

The types of all or nearly all the species described in this paper have been sectioned up and are now in the form of microscopical slides in the collection of the California Academy of Sciences at San Francisco, Calif. The types of the Vega Expedition will be forwarded to the Royal Academy of Sciences in Stockholm. Cotypes of the species collected by the Harriman Expedition have been deposited with Prof. Trevor Kincaid in the University of Washington, at Seattle, and with Prof. W. E. Ritter in the University of California, at Berkeley.

Gustav Eisen.

August 15, 1903.

EXPLANATION OF TERMS.

The following terms used in this paper require some explanation in order to be fully understood.

Accessory glands. — All glands which open around the base of the sperm-ducts, but which do not originate inside the penial bulb. The accessory glands do not stand in any direct connection with the sperm-ducts. Typical accessory glands are found in *Mesenchytræus franciscanus*, *M. pedatus*, and *M. solifugus*.

Ampulla. — The distal, generally inflated part of the spermatheca. The ampullar part is often furnished with diverticles at its base, these diverticles resembling the ampulla in structure, but differing from the duct of the spermatheca.

Atrium. — That enlargement of the sperm-duct situated in the cœlomic cavity immediately adjoining the penial bulb. Sometimes there are two more or less similar enlargements. In such cases the upper enlargement is named atrium, while the lower one, closer to the pore, and which is generally situated inside the penial bulb, is designated 'penial chamber.'

Atrial glands. — Glands which are situated free in the cœlomic cavity and which open into the atrium. The ducts of these glands may open between the inner epithelial cells in the atrium, or they may run down in the atrium and open at the base of the sperm-ducts. The atrial glands are also known as prostates.

Cardiac gland. — The inner glandular structures in the dorsal vessel (Herzkörper of Michaelsen).

Chylus cells. — Large intestinal cells perforated longitudinally by a canal. These cells are found only in a few genera, and generally alternate with common epithelial cells in the intestine. Their form and location are characteristic of the species. Generally located in the vicinity of the clitellar somites.

Copulatory papillæ. — The exterior penial papillæ situated close to or surrounding the spermiducal pores. Protuberances serving as exterior copulatory organs.

Cyanophil lymphocytes. — Lymphocytes which when double-stained take the blue anilin stains.

Eosinophil lymphocytes. — Lymphocytes which when double-stained take the red eosin stain.

Intra-penial glands. — Glands which are situated inside the penial part of the sperm-duct. These glands are enclosed by the penial envelope and open at the lower apex of the penis, but always inside, never outside the penis. Typical in *Mesenchytræus harrimani.*

Penial bulb. — The bulbous muscular and glandular structure situated at the base of the sperm-duct in *Mesenchytræinæ* and *Lumbricillinæ*. The structure of the bulb is of importance in characterizing the species.

Penial papillæ. — Smaller or larger papillæ consisting of unicellular glands situated inside the body in the vicinity of the spermiducal pores. Found only, so far as known, in *Enchytræinæ*. Possibly also in *Anachætinæ* the cells of the penial papillæ never enter the sperm-ducts.

Penial chamber. — The lowest enlargement of the sperm-duct situated below the enlargement designated as atrium. So far as known no glands open into the penial chamber.

Peptonephridia. — Glands resembling nephridial structures, opening into the pharynx. The name 'peptonephridia' was first introduced by Benham and later adopted by Michaelsen and others for structures formerly designated as salivary glands. As these structures greatly resemble the nephridial ducts, and differ characteristically from such glandular structures as the segmental and sexual glands, a distinct name for them is appropriate.

Salivary glands. — See peptonephridia.

Sexual papillæ. — Glandular papillæ projecting exteriorly from the body-wall, in the vicinity of the penial pore. The interior glandular structures are designated 'penial bulb' or 'penial papillæ,' the latter in *Enchytræus*, the former in *Mesenchytræus* and other genera.

Spermiducal apparatus. — The sperm-funnels, sperm-duct, penial bulb and accessory, atrial and penial glands.

Spermatheca. — Sperm-pockets (Samentaschen). The pore generally in $\frac{4}{5}$. The lower narrow part is the duct, the upper thin-walled part is the ampulla, which is often furnished with diverticles at its base.

Septal glands. — Unicellular glands, grouped in fascicles, opening in the palate, but often projecting several somites backwards. Septal glands may be both dorsal and ventral.

Sperm-sacs. — Sacs covered with integument and attached to the testes. In these sacs the spermatozoa reach their final development. The sperm-sacs are either single, paired, or a separate sperm-sac — testicle-sac — may cap each separate lobe of the plurilobed testes, as in the genus *Lumbricillus.*

Ventral glands. — Peculiar cœlomic glands of unknown quality, but probably of sexual nature, found in the vicinity of the ventral ganglion in certain genera. In some instances these glands are intimately connected with the ventral nerve trunk, in other instances they are merely in exterior contact with the ventral nerve trunk. They always penetrate the body-wall and open through it immediately under the ventral nerve trunk. The inner, or distal, ends are free in the cœlomic cavity, or may be united with the ventral nerve trunk. ('Kopulationsdrüsen' of Ude and Michaelsen; 'Copulatory glands' and 'Outgrowths of nerve cords' of Beddard.)

IMPORTANCE OF THE PENIAL BULB IN CLASSIFICATION.

The present arrangement of the various genera is partly tentative. Until now the structure of the penial bulb has not been critically examined, except in a few species besides those described in this paper, and it is in reality only a supposition that the structure of the penial bulb is uniform in the respective species of a genus. I think, however, this assumption will prove to be correct. The species within each of the genera which have been examined have proved to correspond in all particulars to such an extent that it may be safely assumed that the other species also will agree.

Of the genera of the family, I have not had any opportunity to examine *Bucholzia* and *Achæta*. Of *Bucholzia* I have not been able to find any description referring to the structure of the penial bulb, and this genus is simply inserted in the subfamily Lumbricillinæ on account of its undoubted relationship to the genus *Henlea*. *Chirodrilus*, which has not been seen by any recent investigator of this family, is appended for convenience sake. Of its interior structure we know nothing.

Structure of the penial bulb.— The copulatory cushion or penial bulb is of considerable importance in the classification of Enchytræidæ, and I have as far as it has been possible investigated its structure in all the species described in this paper. In some instances the preservation of the specimens has not been sufficiently perfect to allow a minute microscopical study of these complicated structures, but these instances have been comparatively few, and it seems almost certain that a great uniformity of structure exists in the different species of the same genus, or in the same genera of the various subfamilies. The structure of the penial bulb or corresponding organs can therefore be said to be highly characteristic of both species, genera and subfamilies. As previous investigators have paid little or no attention to the finer structure of these sexual organs I will here refer to them more in detail in order that the following classification may be better comprehended.

In nearly all species of this family there exist one or several peculiar cushions in the vicinity of the spermiducal pore — the pore in which opens the sperm-duct leading from the funnel. This cushion or bulb is either intimately connected with the lower part of sperm-duct in such a way that the lower part of the duct is enclosed by the bulb, the spermiducal pore then being situated nearly in the center of the outer surface of the bulb. Or the pore of the sperm-duct may be situated entirely exterior to the penial bulb and in no way connected with the many glands which generally are found in the bulb. This latter seems to be characteristic of the subfamily of Enchytræinæ, while the former is the case in the other subfamilies so far as is known.

As regards the structure of the penial bulb there are also some great and very interesting differences. For instance, the bulb may be traversed by numerous trabecula or muscular strands, in two or more directions, longitudinal or fan-shaped, and circular. The former strands run from the body surface to the periphery of the bulb, while the latter form a circular layer in the bulb. These strands separate the glands found in the bulb from each other. In another type of bulb there are no such strands of muscles to be found separating the glands, the latter being closely packed without any intermediary muscles or even connective tissue. The muscular bulb is found in Mesenchytræinæ, while the non-muscular bulb is found in Lumbricillinæ.

In several species the bulb is either insufficiently developed or of a degenerated type, but even in such species there are generally some characteristic features left, enabling us to assign it to its proper type.

In *Lumbricillus* the bulb is surrounded by a thick muscular layer, being a continuation of the body wall. This is also the character of the bulb in *Bryodrilus*, and is probably found in all the other species in the subfamily. In Enchytræinæ the muscles of the bulb are more numerous, forming often a thick padding over the glands of the bulb, and even penetrating between them. But there are no bands of muscles connecting the body wall with the periphery of the bulb as in Mesenchytræinæ. Instead of one single bulb we find in Enchytræinæ a number of smaller and as regards size varying glandular cushions, succeeding one another both in the longitudinal and the transverse diameter of the worm.

If we thus summarize the above facts we find that in this family there exist three distinct kinds of penial bulbs, differing as regards their finer structure.

The Mesenchytræid bulb is a single muscular structure, containing circular muscles as well as fan-shaped muscular bands connecting the body wall with the periphery of the bulb. Between the muscular bands are generally found numerous penial glands which open on the surface of the bulb around the penial pore. The sperm-duct penetrates the bulb, opening on the center of its outer surface.

The Enchytræid bulb is multiple, consisting of several separate cushions grouped around the penial pore. In these cushions we find several sets or fascicles of glands, each fascicle opening by itself on the surface of the body. There are no muscular bands connecting the base of the cushions with its periphery. The sperm-duct never penetrates the bulbs or cushions but opens close to and independently of them. Exterior to the cushions there are numerous muscles connecting the body wall immediately surrounding the pore with other parts of the same somite.

The Lumbricillid bulb is always single and covered with a strong muscular layer, which however never penetrates down between the cells of the bulb. There are generally two or three distinct sets of glandular cells in the bulb. Some of these open in the lower part of the sperm-duct, or rather in a narrow groove in the elongation of the sperm-duct. Others open on the free surface of the bulb, either irregularly or in narrow circular fields, bunched into fascicles. The sperm-duct penetrates one side of the bulb. In *Bryodrilus* the gland which opens in the extension of the sperm-duct is covered with a thin cushion of muscular strands, forming a bulb within a bulb.

Structure of the atrium and its glands. — The structure of the enlargement of the sperm-duct which I have designated as atrium is a complicated one, especially in *Mesenchytræus*. In the subfamilies of Lumbricillinæ and Enchytræinæ the sperm-duct continues to the pore, even through its passage through penial bulb, without any enlargement, and without being joined by any atrial or accessory glands. Any reference to the finer structure of the sperm-duct proper in these two subfamilies is therefore not necessary. But in *Mesenchytræus* the structure is often so complicated and so varied that it generally furnishes important characteristics of the species. In many species there exists an atrial enlargement just outside of the penial bulb, while many species possess also another enlargement inside the penial bulb, close to the penial pore. For the former I have retained the name 'atrium,' for the latter 'penial chamber.' Both these enlargements may be connected with various kinds of glandular cells. These cells are either single or, more frequently, grouped in fascicles in the same manner as the septal glands. All the various glands in the family resemble one another in that the respective cells open independently of each other through a long and narrow duct. In no instance is there a common lumen for the various cells, though they may be grouped together in fascicles, in which the long and exceedingly narrow ducts run parallel to each other for some considerable distance. This is especially the case with the atrial glands. These glands occur generally in fascicles, which lie free in the cœlomic cavity, but send their fine, thread-like ducts into the atrium of the sperm-duct. In many species the ducts of the fascicles are surrounded by circular muscles in the immediate vicinity of the sperm-duct. In other species these circular muscles are wanting. If we follow these fine hair-ducts of the cells we find that some of them after having penetrated the muscular coat of the sperm-duct, enter between the inner epithelial cells of the atrium, and empty their contents into the atrial lumen. Other ducts again do not open into the lumen at once, but run either up or down between the epithelium of the atrium and its muscular layers, and only enter the atrial lumen a considerable distance from the place where they penetrated the atrial covering. In many species the glandular ducts form a thick layer of fine thread-like ducts, which layer is thicker than any of the atrial layers proper. While some of the ducts from the glands enter the atrial lumen without being enlarged or widened out, others first widen out, forming a small pocket in which their granular contents are stored. The number and location of the atrial glandular fascicles vary in different species. In some instances they penetrate the atrium in the same equatorial plane, while in other species they cover the atrium in an irregular manner. In some species these fine ducts of the cells continue downward in the atrium but open only at the penial pore on the surface of the body-wall. In some species the atrial glands are wanting, while in others they seem to be replaced by minute glands situated entirely inside the atrium near the penial pore.

Another set of glands connected with the spermiducal organ consist of accessory glands, which open near the penial pore, but which stand in no connection with either the sperm-duct or the penial bulb. In some species there are many accessory glands arranged in a ring in the cœlomic cavity around the bulb and opening along a circular band around the penial pore. But in other species there may be only two or even one single fascicle of accessory glands opening in a pore by itself, but in the immediate vicinity of the penial pore. In structure these glands resemble the atrial and penial glands (figs. 10, 32). The exterior pore of these accessory glands is often very large, reminding us of the tubercula pubertatis in the higher Oligochæta.

At the lower end of the sperm-duct we find in many species, both of *Mesenchytræus* and *Lumbricillus*, etc., a set of very small glands which appear to open directly in the sperm-duct. These glands are often enclosed within the muscles of the sperm-duct, and appear as an enlargement of the duct. But it is to be noted that the surface on which these glands open is destitute of any epithelial cells, those of the sperm-duct always ending where the glands commence. I have, therefore, referred to these glands as opening in the prolongation of the sperm-duct instead of in the duct itself. In the genus *Mesenchytræus* these glands are found only in few species, while in Lumbricillinæ they are found in all species examined by me.

The various glands of the spermiducal apparatus.—In the foregoing as well as in the following paragraphs the various glands of the spermiducal apparatus have often been referred to in their respective places. As their number is considerable and as their structure is somewhat complicated I will here summarize their most important characteristics and endeavor to classify them according to their nature and location. There are at least five different kinds of glands opening into or in the proximity of the sperm-duct.

The first group of glands are those which open in the sperm-duct exterior to the penial bulb. These are the atrial glands which, as we have seen, may directly penetrate between the atrial inner epithelium and open into the atrial chamber and pour their secretions there. Or they may follow between the atrial epithelium and the atrial muscular layers and empty their contents around the penial pore. An illustration of the former is seen in *Mesenchytræus maculatus* (pl. v, fig. 5). The latter is illustrated in *Mesenchytræus grandis* (pl. vii, fig. 2).

Another group of glands in the lowest part of the sperm-duct, or more particularly in the short extension of the sperm-duct, is found in many species of Lumbricillinæ and in some species of *Mesenchytræus* for which see pl. xi, fig. 4 (*Mesenchytræus asiaticus*), and pl. xv, fig. 7 (*Henlea guatemalæ*). Such glands I have referred to as 'intrapenial glands.'

Another group of glands are designated 'copulatory glands.' These glands are found inside the penial bulb, but do not open into the sperm-duct, but around the spermiducal pore, on the body surface of the penial bulb. Such glands are seen in pl. xi, fig. 4 (*Mesenchytræus asiaticus*), and in pl. xviii, fig. 1 (*Lumbricillus annulatus*).

The copulatory glands may open separately, as in pl. xiv, fig. 1 (*Marionina americana*), or they may open in fascicles in separate pores, as in pl. xv, fig. 6 (*Henlea ehrhorni*). The two kinds of glands may be found in the same penial bulb, and their arrangement and occurrence are probably characteristic of the species.

The fourth class of glands is the accessory glands which open outside of the penial bulb, as illustrated in pl. ix, figs. 5, 6 (*Mesenchytræus pedatus*).

Another set of glands are those found in *Enchytræus*, which open in groups outside of the penial pore (pl. xix, figs. 1 and 6).

ENCHYTRÆIDÆ OF NORTHWEST COAST OF NORTH AMERICA

SYNOPSIS OF SUBFAMILIES AND GENERA

I. Subfamily *MESENCHYTRÆINÆ.*

The penial bulb consists of a muscular cushion containing muscular strands mostly radiating from the base of the bulb, but also running in a peripheral manner. Among these muscular strands are often found numerous glandular cells arranged in sets, which open onto the basal surface of the penial bulb. The sperm-ducts penetrate the bulb but the glands in the bulb do not open into the ducts. Setæ sigmoid in four fascicles on each somite. No dorsal pores.

An atrium and atrial glands generally present. Dorsal vessel rises posterior to clitellum and is furnished with cardiac gland. One pair of sperm-sacs and a single median ovisac. Head-pore generally at the apex of the prostomium. Nephridia pluri-lobed, with wide closely wound canals..........................1. *Mesenchytræus* Eisen.

II. Subfamily *ENCHYTRÆINÆ.*

No large compact penial bulb, only one or more smaller or larger papillæ, consisting of a number of unicellular glands arranged in sets, in which the individual cells radiate in a feathery or fan-shaped manner from a common point on the base of the papillæ. A few muscular strands penetrate between the glandular sets, radiating from the base of the papillæ to the parietes or body-wall situated laterally to the ventral ganglion. Sperm-ducts open independently of the penial papillæ, though in their immediate vicinity. Never any atrium. Setæ always straight when present. Nephridia not pluri-lobed. No intestinal diverticles. Peptonephridia glands present or absent. No dorsal pores.

Four fascicles of setæ in each somite and more than one seta in each fascicle..2. *Enchytræus* (Henle).

No fascicles of setæ. Setæ single or even entirely absent in many somites ....3. *Michaelsena* Ude.

III. Subfamily *ACHÆTINÆ.*

No setæ, only glandular sacs, projecting from the body-wall into the cœlomic cavity. The penial bulb consists of numerous glandular cells arranged in a fan-shaped manner (the finer details of this structure are not known).

Dorsal vessel rises anterior to clitellum. Unpaired peptonephridia. Head-pore at the apex of the prostomium. Nephridia with a very large anteseptal, not pluri-lobed. No dorsal pores. Blood colorless. Chylus cells in the intestine....................4. *Achæta* Vejd.

IV. Subfamily *LUMBRICILLINÆ.*

The single penial bulb contains as a rule no muscular strands, but is covered by a strong investment of muscles, which, however, never penetrate into the bulb. The bulb contains a great number of unicellular glands, which open either on the basal surface of the bulb or into the extension of the duct. The sperm-ducts penetrate the bulb and open in conjunction with the glands. No atrium. No accessory glands. Setæ in fascicles of four. Nephridia not pluri-lobed. Head-pore between prostomium and somite I.

A. Setæ always sigmoid and arranged in a fan-shaped manner in the fascicle. Dorsal vessel rises posterior to clitellum. No dorsal pores. No cardiac gland. Blood red. Esophagus gradually merging into the intestine. Sperm-sac caps each testis-lobe. No peptonephridia.

Testes pluri-lobed...................................5. *Lumbricillus* Clap.

Testes massive and undivided..............6. *Marionina* Michaelsen.

B. Setæ sigmoid or straight. Dorsal vessel rises anterior to clitellum. No dorsal pores. Blood colorless. Intestine with or without pouches.

Dorsal vessel without cardiac gland, rises from an anterior dorsal diverticle of the intestine. Esophagus merges suddenly into the intestine. Rudimentary salivary glands. Setæ sigmoid.
7. *Bucholzia* Michaelsen.

Dorsal vessel rises anterior to clitellum, but not from a dorsal diverticle of the intestine. A cardiac gland. No diverticles of the intestine. Esophagus gradually merging into the intestine. No peptonephridia. Setæ sigmoid...........8. *Stercutus* Michaelsen.

Dorsal vessel rises in the clitellar somites. Intestine with four diverticles in VIII. No sperm-sacs. No dorsal pores. Nephridia with minute anteseptal. Setæ sigmoid or straight. Rudimentary peptonephridia.......................................9. *Bryodrilus* Ude.

Dorsal vessel rises from a sinus in VIII, formed by the junction of esophagus and intestine, which suddenly merge into each other. Intestine with two to four intestinal pouches or with none. Large peptonephridia. Setæ sigmoid or straight.

10. *Henlea* Michaelsen.

C. Setæ straight, the inner ones always shorter than the outer ones. Dorsal vessel rises posterior to clitellum. Blood colorless. Intestine without pouches. Two kinds of lymphocytes. Dorsal pores in the dorsal median line half way between the septa.

Four fascicles of setæ. Dorsal pores begin with VI or VII. Chylus cells in some somites in the vicinity of clitellum. No cardiac gland. Peptonephridia simple or branched.

11. *Fridericia* Michaelsen.

Only the ventral fascicles of setæ present, anteriorly 4 setæ, posteriorly rarely more than one seta in each fascicle. A cardiac gland. Dorsal vessel post-clitellial. Some of the anterior septa are thickened...12. *Distichopus* Leidy.

D. Six fan-shaped fascicles of setæ in each somite. Two fascicles are ventral, two lateral and two subdorsal. The setæ in the ventral and lateral fascicles four to nine, simple, acute, curved like an italic *f*; those of the dorsal fascicles stouter and less curved, three to six in each fascicle. Blood colorless.

13. *Chirodrilus* Verrill.

SYSTEMATIC DISCUSSION OF GENERA AND SPECIES.

Subfamily *MESENCHYTRÆINÆ.*

This subfamily includes for the present only the single genus, after which the subfamily takes its name. In his arrangement of the family Michaelsen places *Stercutus* close to *Mesenchytræus* on account of the sigmoid setæ. It seems to me, however, more probable that this genus is more closely related to Pachydrilinæ on account of the form of its nephridia. The structure of the penial bulb of *Stercutus* is not known to me.

The penial bulb is in some species of *Mesenchytræus* rather reduced in size as well as variable in structure, but all the species agree in having the lower part of the sperm-duct invested by muscles, which in some instances are of most powerful nature, reminding us of the muscular arrangement of the penial duct in certain species of *Limnodrilus*, where these muscles are spirally twisted around the duct. The ducts enter the penial bulb always from the top, never from the side or from the bottom, as, for instance, in *Fridericia*. Throughout their course in the bulb the ducts are separated by strong muscles from the muscles of the bulb, a character not found in the other subfamilies. The structure of the bulb will be described more in detail under the genus *Mesenchytræus*. For a definition of the family we refer to the synoptic table of the genera.

Genus **Mesenchytræus** Eisen.

Definition. — Setæ sigmoid, generally more numerous in the ventral fascicles. Head-pore generally near the apex of prostomium. No dorsal pores. Dorsal vessel rises posterior to clitellum, with cardiac gland. Blood colorless or red. Brain generally truncate posteriorly, generally broader than long. Nephridia with anteseptal, consisting of the nephrostome, and with a deeply and irregularly pluri-lobed postseptal, in which the ducts are wide and situated close together. No salivary glands. Septal glands present. An atrium generally present. Atrial and accessory penial glands present in many species. A single median ovisac. One pair of sperm-sacs generally of large size. Sperm-duct generally broad and short. Spermatophores present in several species. Penial bulb when present contains muscular strands which radiate from the base towards the periphery of the bulb.

The above definition is slightly modified from the one given by Michaelsen and Beddard. The points in question refer to the color of the blood, to the presence of spermatophores in some species, and to the nature of the penial bulb. An atrium or enlargement of the sperm-duct is found in most species and may be said to be fairly characteristic of the genus; its absence is certainly the exception. In the following we will consider in detail only such characters as are less known.

DETAILED DESCRIPTION.

Brain. — The form of this organ is less characteristic of the genus than was supposed when the genus was established. The posterior margin, while generally truncate posteriorly, is in many species convex, while in a few it is even concave. But this convexity or concavity is never as large as in the other genera, and coupled with some other characteristics, is frequently a guide to the genus. These supplementary peculiarities of the Mesenchytræid brain are that it is generally deltoid, tapers posteriorly, and is broader than long. It is also frequently deeply emarginated in front. Whenever we find several of these characteristics together we may be reasonably sure that the species belongs to the genus *Mesenchytræus*.

Spermathecæ.—These organs show a great variation in form and in the number of diverticles. The latter offer a most convenient character upon which to base a systematic arrangement of the species. In the following I have adopted the number of diverticles of the spermatheca as a most convenient characteristic for the different groups. There are also points in the structure of the spermatheca which are of great interest. In a large block of species, which also otherwise seem to be related, the terminal ampulla of the spermatheca is greatly enlarged and extends backward through a number of somites. As might be expected, nearly all such spermathecæ are closed and do not connect with the intestine. The exception is found in *M. vegæ* in which the spermatheca is connected with the intestine by a narrow duct, which, however, springs out laterally from the ampulla instead of from its inner apex. There is some little reason to suspect that this enlargement of the spermathecæ in this genus may have been overlooked in some species, and that some spermathecæ which have been described as short and as immediately connecting with the intestine, in reality are greatly prolonged posteriorly. The part adjoining the diverticles is always narrow and closely approaches the intestine. This peculiarity causes it to tear readily and I am satisfied that some such torn spermathecæ have been considered as entire. A similar enlargement of the spermathecæ is not known to exist in any of the other genera of this family.

Spermiducal apparatus.—The spermiducal apparatus in *Mesenchytræus* is as a rule most characteristic. This refers especially to the sperm-duct and to the various glands connected with it. In nearly all species of this genus there exists an enlargement of the sperm-duct just before it enters the penial bulb. I have retained for this enlargement the name 'atrium.' In this atrium there open in many species glands, in form, size, and structure resembling the atrial glands of *Limnodrilus*. In some species there are only a few glands, in others there are as many as fifteen or more. The atrial glands consist of fascicles of unicellular glands, each cell opening independently of the adjoining cells. The glands open in various places. As a rule they penetrate the atrial wall in a fascicle surrounded by circular muscles, though these latter may be absent. After having penetrated the atrial wall, the ducts of the glands may open into pockets between the epithelial cells lining the atrium, or the ducts may enter directly between the cells of the atrium. In other species, again, these ducts run all the way down to the pore of the penis and open there between the epithelial cells, or they may continue to the very pore, opening onto the free surface around the pore, still remaining inside the sheath of the sperm-duct. In some instances the ducts of these glands spread out between the epithelium and the muscular layers of the atrium and form a thick layer of irregularly running threads. Some of these narrow ducts run upwards in the atrium, while others run downwards to the pore some little distance before they finally penetrate the epithelium of the atrium in order to empty their contents in the atrial lumen. Through this arrangement nearly the whole anterior surface of the atrial lumen is evenly lubricated by the secretions of the glands and clogging at any given point is most effectually prevented. The individual ducts of the glands are so minute that they may be readily mistaken for fibers. The lumen of the duct is not demonstrable by present microscopical means and the nature of the duct can only be judged by following some of the ducts until they empty their content in the atrial chamber. The great variety of arrangement of these glands is illustrated in the various figures.

Accessory glands. — As 'accessory glands' I have referred to glands which open around the penial bulb and which do not enter this bulb. In structure the accessory glands resemble the atrial glands, and like them are composed of fascicles of unicellular glands, the ducts of which never fuse. Accessory glands are comparatively rare. So far they are found in only a few species, such as *M. pedatus*, *M. solifugus*, *M. fontinalis*, and *M. franciscanus.* In the latter species there is only one accessory gland, but this one is of enormous size (Pl. IV, fig. 4).

Penial glands. — As 'penial glands' I refer to all glands which are confined to the penial bulb. They are of at least three distinct kinds, according as they open into the sperm-duct, into the penis, or simply around the penial pore. The majority of the penial glands open around the pore outside of the sperm-duct. Other smaller glands penetrate the sperm-duct from the exterior, while other glands are entirely confined to the interior of the sperm-duct. Of the latter we have examples in *M. asiaticus*, *M. maculatus*, *M. grandis*, and *M. beringensis.*

Any of the above-mentioned glands may be present or absent. Very few species possess all the various kinds, and in but one species, so far as now known, are they all absent. The presence or absence of the various kinds of glands constitutes most excellent species characteristics.

Penial bulb. — As 'penial bulb' I designate the large muscular cushion which in the vast majority of species, surrounds the lower part of the sperm-ducts. This penial bulb differs in structure from the corresponding organ in all the other genera of this family, so far as they are known to me. In *Mesenchytræus* the penial bulb is made up of a large number of muscular strands, both longitudinal and transverse. Between these strands are situated the penial glands. In the penial bulbs of the other genera there exist no such muscular strands, the bulb consisting simply of a large number of unicellular glands situated close together and surrounded by a thin muscular covering, there being no muscles inside the bulb. This structure of the penial bulb is so characteristic that I have added it to the definition of the genus. In no single instance is a penial bulb of the construction so common in *Mesenchytræus* found in any other genus, and similarly in *Mesenchytræus* no bulb of a structure similar to that of *Lumbricillus* and *Fridericia*, etc., has ever been observed.

On the other hand, it is true that in some species of *Mesenchytræus* we meet with a greatly degenerated penial bulb. Thus, for instance, in *M. fontinalis* and in *M. pedatus* the penial bulb is so diminished that it may be said to be virtually absent, its place having been taken by a few penial glands surrounding the pore.

In *M. orcæ* and *M. kincaidi* the bulbs are small and not furnished with any glands, but their muscular structure is distinct.

Spermatophores. — In my original definition of the genus *Mesenchytræus* (Eisen '79) I mentioned the presence of sperm-balls. Since that time no similar structures have been observed in any Enchytræid species until now. As will be described more in detail, spermatophores are actually present in several species and are especially prominent in *M. franciscanus.* The spermatophores are found free in the cœlomic cavity after having been fully developed in the sperm-sacs. In the species described in this paper the spermatophores are never found in the sperm-funnels or in the spermathecæ. This, however, does not exclude the possibility that in other species they may be found to occur in such organs.

SYNOPSIS OF SPECIES OF MESENCHYTRÆUS.

In order to facilitate the examination of the various species of this genus, I have compiled the following table, based on a reexamination of the old descriptions of such species as were previously known. It need hardly be stated that in none of the older descriptions was the structure of the atrium and its tributary glands referred to in detail. This makes it necessary to base the arrangement of the species on some other characters, as, for instance, on the presence or absence of diverticles of the spermatheca and upon their number. The largest number of species belongs to the group with two diverticles. This group may be further subdivided according to the nature and size of the spermathecæ. Other subdivisions are based on the presence or absence of the glands accompanying the sperm-ducts. In the following table I have enumerated several species which are insufficiently described, but which are sufficiently well defined to be identified. This refers to all species which have been described from dissections only, the finer histology not having been studied.

I. SPERMATHECA WITHOUT DIVERTICLES.

1. Sperm-ducts thick and short. Penial bulb long and tapering. Small penial glands confined to the bulb. No atrial and no accessory glands. Spermatheca twisted at the pore. Brain posteriorly strongly emarginated. 1. *M. unalaskæ* sp. nov.
2. Sperm-ducts short and narrow. Spermatheca straight and of even thickness. Head-pore between prostomium and somite I. Body transparent. Brain posteriorly slightly convex. Sperm-sac confined to XII. 2. *M. fenestratus* (Eisen, '79).
3. Sperm-ducts short and narrow. Penial bulb short and ellipsoidal. Spermatheca straight and of even thickness. Brain posteriorly slightly emarginated. Narrow part of sperm-funnel helix-like. 3. *M. falciformis* Eisen, '79.
4. Sperm-ducts short and broad, three or four times as long as the funnel. Spermatheca with an apical ampulla at the junction with the intestine. Brain slightly emarginated posteriorly.....4. *M. flavidus* Michaelsen, '87.
5. Spermathecal pore not conspicuous. Spermathecæ club-shaped. Body dark, pigmented, but not quite black. Brain posteriorly concave. Ice worm from Malaspina Glacier.........................5. *M. niveus* Moore, '89.
6. Setae, dorsal: 3 to 5; ventral: 6 to 9. Head-pore at apex. Brain square, posteriorly emarginated. Sperm-funnel about square, small. Sperm-duct short. Spermatheca sac-like, folded, without diverticle; connected with intestine; duct half as long as the ampulla. 6. *M. montanus* Bretscher, '99.
7. Sperm-duct short and thin. Spermatheca large, sac-like, not connected with intestine. Brain posteriorly deeply emarginated. Setæ 3 to 6. Lymphocytes pointed oval, dark with large granules......7. *M. tigrina* Bretscher.

II. SPERMATHECA WITH ONE DIVERTICLE.

1. Spermatheca with a pear-shaped diverticle at the center. No enlarged lateral setæ. Sperm-sacs confined to XII. Head-pore at the apex of prostomium. Setæ: laterals 3, ventrals 5. Funnel short, and sperm-ducts short and hardly convoluted.........................8. *M. flavus* Lev., '84.

2. Spermatheca with an olive-shaped diverticle near the intestinal end. Enlarged lateral setæ in V to VII. Head-pore close to anterior margin of prostomium. Brain slightly emarginated posteriorly. Sperm-sac short, confined to XII. Clitellum $\frac{1}{2}$ XI to $\frac{1}{4}$ XIV. Glands around the penial bulb...9. *M. setosus* Michaelsen, '88.

3. Dorsal setæ in IV to VI twice as long as the others (1 or 2 in each somite). Spermatheca?...10. *M. armatus* Lev, '84.

4. Spermatheca with a small pear-shaped diverticle at the center. No enlarged setæ. Sperm-sacs large, extending back many somites. Head-pore half way between somite I and apex of prostomium. Lateral setæ 2, ventrals mostly 4. Sperm-ducts long. Funnels long.
11. *M. asiaticus* sp. nov.

5. Sperm-ducts short and thick, about five times longer than funnel. Setæ, ventral: 5 to 12, dorsal: 2 to 3, those in V, VI, VII, in dorsal fascicles larger. Spermatheca with one (?) diverticle. Brain posteriorly emarginated...12. *M. megachætus* Bretscher.

III. SPERMATHECA WITH TWO DIVERTICLES.

A. **Spermathecæ unusually enlarged, extending through several somites posterior to V.**

1. Spermathecæ not connected with the intestine. Penial glands, about 12 long atrial glands; no accessory glands. Brain square or broader than long...13. *M. harrimani* sp. nov.

2. Spermathecæ not connected with the intestine. About five atrial glands; penial glands; no accessory glands. Brain rounded.
14. *M. setchelli* sp. nov.

3. Spermathecæ not connected with the intestine. About ten atrial glands; penial glands; one large accessory gland. Brain almost square.
15. *M. franciscanus* sp. nov.

4. Spermathecæ not connected with the intestine. About fourteen atrial glands opening into the atrium in different planes; penial glands; no accessory glands. Brain broader than long, slightly emarginated posteriorly..16. *M. obscurus* sp. nov.

5. Spermathecæ connected with the intestine. About twelve atrial glands; penial glands; no accessory glands. Brain broader than long, posteriorly emarginated...17. *M. vegæ* sp. nov.

6. Spermathecæ not connected with the intestine. Several atrial glands; no penial glands and no accessory glands. Brain longer than broad with a slight emargination...................................18. *M. orcæ* sp. nov.

7. Spermathecæ not connected with the intestine. At least 12 atrial glands opening in pockets between the epithelial cells; many penial glands; no accessory glands. Brain deltoid, with slight posterior emargination.
19. *M. maculatus* sp. nov.

B. **Spermathecæ not enlarged and not extending posteriorly beyond somite V.**

a. No atrial, penial, and accessory glands connected with lower end of sperm-ducts.

Brain posteriorly convex. Diverticles as long as the ampulla of the spermatheca, and much longer than the duct leading to the pore.
20. *M. kincaidi* sp. nov.

b. Atrial and penial glands present in connection with the sperm-ducts but no accessory glands at the male-pores.

1. Spermatheca short and thick; diverticles have the form of shallow outbulgings of the spermathecal wall. Four atrial glands.
21. *M. penicillus* sp. nov.

2. Diverticles longer than the ampulla of spermatheca. Brain posteriorly slightly emarginated. About 8 long atrial glands. Lymphocytes round. Length about 17.9 mm..........22. *M. grandis* sp. nov

3. Diverticles shorter than the ampulla of spermatheca. Brain broad, posteriorly emarginated. About 6 globular atrial glands. Lymphocytes ellipsoidal, fringed. Length about 15 mm. 23. *M. fuscus* sp. nov.

4. Diverticles about equal in length to the stalk as well as to the ampulla of spermatheca. Brain square, truncate posteriorly. Two atrial glands. Lymphocytes ellipsoidal, without fringes. 24. *M. eastwoodi* sp. nov.

5. Diverticles simple, slightly shorter than the ampulla of spermatheca. Sperm-duct about equal in length to the funnel. Brain broad, slightly emarginated posteriorly............25. *M. primævus* Eisen, '79.

6. Diverticles broader than the ampulla but about as long; shorter than the stalk. Brain posteriorly narrower than anteriorly, slightly emarginated. Head-pore anterior to the center of prostomium. Sperm-duct about 8 times as long as funnel. Lymphocytes ellipsoidal, almost circular.................... 26. *M. beumeri* Michaelsen, '86.

7. Diverticles form merely a central chamber between the duct and the ampulla, in which the paired nature of the diverticles is barely perceptible. No specialized sperm-duct, the narrow part of the funnel serving for duct and opening directly into the pore. Brain posteriorly deeply emarginated......................................27. *M. nanus* sp. nov.

c. No atrial glands but accessory glands present in connection with lower apex of the penial bulb; penial glands in penial bulb.

Brain posteriorly slightly emarginated. Two small club-shaped diverticles at the center of the spermatheca...........28. *M. fontinalis* sp. nov.

d. No atrial and no penial glands, but many accessory glands at the lower apex of sperm-ducts.

Brain truncate. Large penial projection of the body-wall. 29. *M. pedatus* sp. nov.

e. No atrial glands. No accessory glands at the male-pore, but many large penial glands inside the bulb.

Brain slightly rounded, tapering posteriorly. Spermathecæ with enlarged pouch opening into the intestine.............30. *M. beringensis* sp. nov.

IV. SPERMATHECA WITH THREE DIVERTICLES.

Brain truncate posteriorly. Atrial glands 6 or more. Numerous accessory glands opening exterior to penial bulb. Penial glands in the bulb trefoil-like...31. *M. solifugus* (Emery, '98).

V. SPERMATHECA WITH 4 OR 5 GLOBULAR DIVERTICLES AT THE BASE OF THE AMPULLA.

Spermatheca turret-like. Sperm-ducts very short and broad. Body intensely blackish brown ....32. *M. mirabilus* Eisen, '79.

MESENCHYTRÆUS UNALASKÆ sp. nov.

Pl. 1, fig. 7; and text-fig. 1.

Definition.—Length 5 mm., width .4 mm. Somites about 40. Anterior four somites thicker than those following. Somites I to III rugose and warty. Setæ : lateral, 4, 4, 4, 3, 3, 3, 2, 3, 2 (XII), 2, 3, 4, 3, 4, 4, 3, etc., 3, 2 ; ventral, 7, 7, 7, 7, 7, etc., 0 (XII), 6, 5, 5, 4, 5, 4, etc. Setæ in ventral fascicles diminish in size toward ventral interval; setæ in lateral fascicles of about equal size. Prostomium prominent but not pointed. Clitellum unknown. Sexual papillæ not projecting. Septal glands large, in IV to VI. Brain posteriorly deeply emarginated. Dorsal vessel rises about XVIII. Intestine posterior to clitellum, with chloragogen glands. Spermathecæ without diverticles, opening into the intestine. Sperm-ducts three or four times as long as the funnels, which are sigmoid. No atrial and no accessory glands. One set of penial glands confined to penial bulb. A pair of long sperm sacs and an ovisac. Nephridia large, plurilobed. Lymphocytes of medium size, eosinophile ellipsoidal. Color of formalin specimen white.

Locality. — Unalaska, Aug. 10, 1899. Collected by Prof. W. A. Setchell. Found under moss.

Characteristics.—One of the smallest species investigated. Specimens found in August not fully developed, clitellum wanting. No atrial glands could be seen, and no accessory glands. Lymphocytes extremely characteristic, being strongly eosinophilous, with red granules surrounded by a pellucid, uncolored zone. Cells in the tissue too small to allow of a more detailed description.

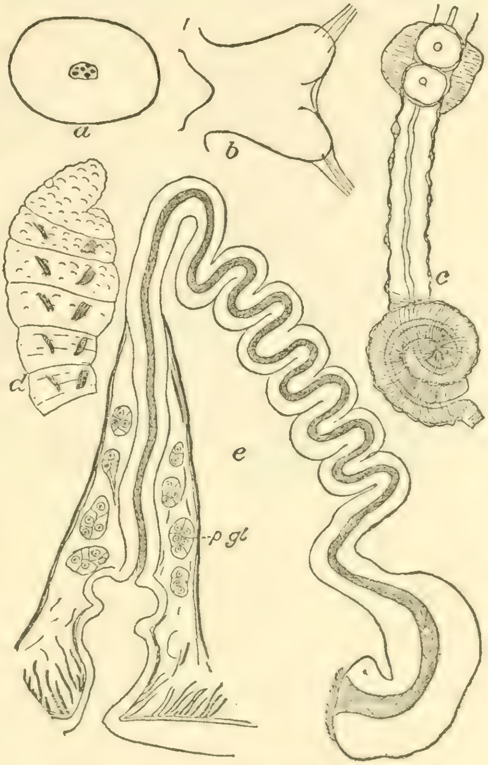


FIG. 1. *Mesenchytræus unalaskæ.*

MESENCHYTRÆUS ASIATICUS sp. nov.

Pl. XI, fig. 4; and text-figs. 2 and 3.

Definition. — Length about 14 mm., width 1 mm. or .9 mm. (contracted specimens). Somites 54. Setæ: laterals, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 2, 3, 3, 2, 2, etc.; ventrals, 4, 4, 4, 4, 4, 5, 4, 6, 5, 5, 0, 4, 4, 4, 3, 3, etc. Prostomium not much pointed, with head-pore half way between apex and somite I. Clitellum prominent, IX to XIII. Sexual papillæ quite prominent. Brain posteriorly more or less deeply emarginated. Dorsal vessel rises behind clitellum. Spermathecæ with long narrow duct and a long narrow ampulla, at the junction of the two a diverticle, variable in size, but always very minute. Sperm-ducts about eight times as long as the cylindrical and slightly curved funnel; atrium with five medium-size atrial glands opening in one plane near the upper end of the atrium. No accessory glands, but numerous penial glands inside the penial bulb. Two long sperm-sacs extending far backward. One ovisac. Nephridia with unusually large nephrostome. Lymphocytes small, ellipsoidal, pointed. Color pale yellow (alcoholic specimens).

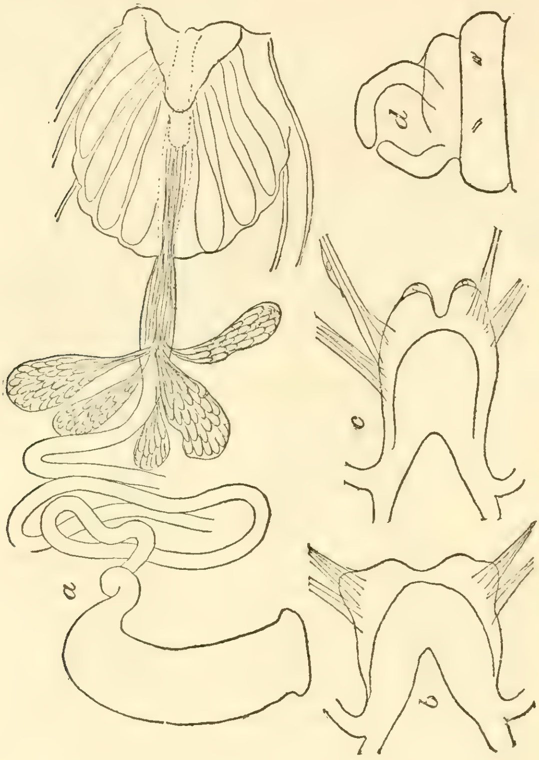


FIG. 2. *Mesenchytræus asiaticus.*

Distribution. — Chuckches' Land, to west of Bering Strait, Asia. Collected during the Vega Expedition under Baron A. E. Nordenskiöld, by Dr. Anton Stuxberg, at 'Jinretlen,' June 15, 1879.

Characteristics. — The shape of the spermathecæ, with their single diverticle and the posterior emargination of the brain, are the leading characteristics of this well-defined species. The large nephrostome distinguishes the species from *M. flavus* Lev, which is said by Michaelsen to possess a small narrow anteseptal. The sperm-duct is much longer than in *M. flavus.*

DETAILED DESCRIPTION.

Setæ. — All of equal length; at least no large specialized setæ; average number in ventral fascicles 4.

Clitellum.—In fully adult specimens the clitellum is white and stands out prominently. This is also the case with the sexual papillæ, which project about one fourth the diameter of the body.

Brain (figs. 2*b* and 2*c*).—This organ varies considerably, but in the majority of specimens dissected the form was about square, more or less deeply emarginated posteriorly and very deeply emarginated anteriorly. This species is thus one of the very few in this genus possessing a brain posteriorly emarginated. One of the specimens possessed a much more elongated brain than the others, but the emargination was even more deep.

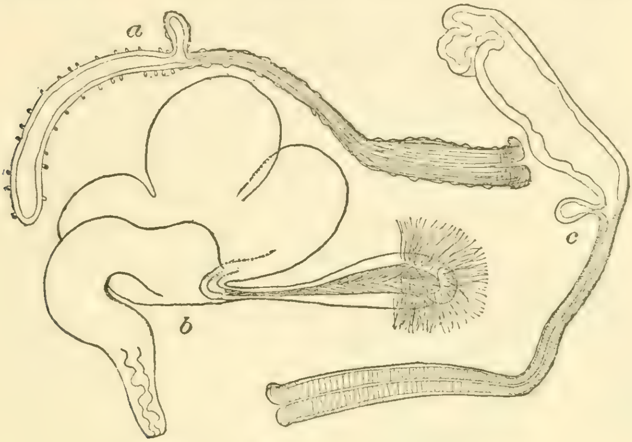


FIG. 3. *Mesenchytræus asiaticus.*

Spermathecæ (figs. 3*a* and 3*c*).—These organs do not connect with the intestine. They extend into somite VI and are thus slightly enlarged. Diverticle varies in size. In the majority of specimens the size is as figured, but in one specimen the diverticle constituted a mere warty swelling. The width of the ampulla varies considerably, the two extremes found in the dissected specimens having been figured.

Spermiducal apparatus (PL. XI, fig. 4).—Funnels rather long and slightly curved. Sperm-ducts probably six to seven times (or more) as long as funnels. They are twined and extend back several somites. In this respect they differ from those of *M. flavus*, which species has short sperm-ducts. The number of atrial glands seems to be always five. Penial bulb is broad, and contains a number of penial glands situated close together. At the base of the sperm-ducts and in the ducts are a number of narrow unicellular glands opening inside the sheath.

Nephridia (fig. 3, *b*). — A larger and especially a broader nephrostome than any other species examined by me. Nephridia of the somites anterior to clitellum much larger than those in the posterior somites. But the ducts leading to the pores of these anterior nephridia are much shorter than the ducts of the posterior nephridia. In the latter the duct is twice or three times as long as in the anterior ones.

MESENCHYTRÆUS HARRIMANI sp. nov.

Pl. I, figs. 1–6; Pl. II, figs. 1–7; and text-figs. 4–6.

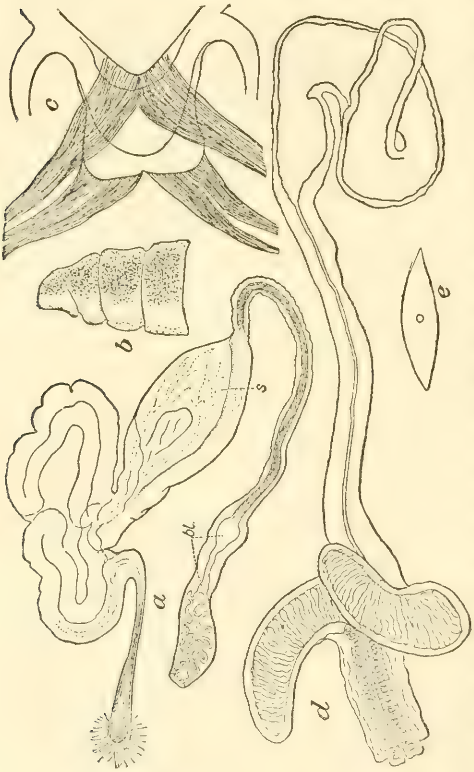


FIG. 4. *Mesenchytræus harrimani.*

Definition. — Length 60 mm. or more; width 2.5 mm. or over. Somites about 100, deeply set. The few anterior somites strongly pigmented on dorsal side; the somites following less and less pigmented, the posterior ones not at all. Setæ strongly curved; laterals, 3, 3, 2, 3, 3, 3, 3, 3, 3, 2 (XI), 0 (XII), 3, 4, 3, 3, 4, 3, 3; ventrals, 5, 5, 5, 6, 5, 6, 6, 6, 6, 5 (XI), 0 (XII), 6, 7, 6, 6, 7, 7, 6, etc. Clitellum XI, XII, and $\frac{1}{2}$ XIII. Sexual papillæ not projecting. Septal glands in IV to VI. Brain square, anteriorly strongly emarginated, posteriorly almost straight and slightly emarginated. Spermathecæ unusually elongated, with two strong diverticles near the base; the apical ampulla several times longer than the basal part, extending to somite X or XI. Sperm-duct about three times as long as the atrium and bulb, and about three times as long as the funnel. Funnel long, narrow, and cylindrical, extending forward through three somites; about six times as wide as the sperm-duct. Bulb large, globular. Atrium medium size, with about sixteen large gland-fascicles opening at the entrance of the atrium into the bulb. One set of penial glands inside the bulb. Sperm-sacs extending back some thirty somites. Nephridia with two principal lobes and with a small urinary bladder at the pore. From this bladder downward the duct is repeatedly twisted, and at least once branched. Color yellowish, with brownish flush on the dorsal side owing to pigment.

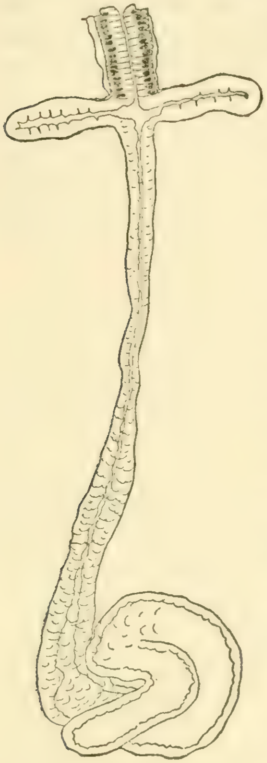


FIG. 5. *Mesenchytræus harrimani.*

Locality. — This, the most gigantic of all the Enchytræids, so far as now known, seems to have an extensive distribution in Alaska, and may possibly reach even as far south as California. Years ago I found a gigantic *Mesenchytræus* at Horse Corral Meadow in the Sierra Nevada of Fresno County, California. The specimen was unfortunately lost before I could describe it, but the similarity to *M. harrimani* is so great that it is not impossible that the two are identical. The elevation of Horse Corral Meadow is maybe about 7,000 feet, so that the altitude would make up for the latitude. Of course it is impossible to know whether or not the specimen was identical with *M. harrimani*, but the outward appearance, so far as I can remember, certainly was the same. The Alaska specimens were collected by members of the Harriman Expedition, principally as follows: By Prof. W. E. Ritter, Kadiak, Alaska, August, 1899; by Prof. Trevor Kincaid, Orca, Alaska, June, 1899; Metlakatla, June 4; Sitka, June; Lowe Inlet, British Columbia, June; Yakutat, Alaska. I possess also several adult specimens collected by Prof. W. A.

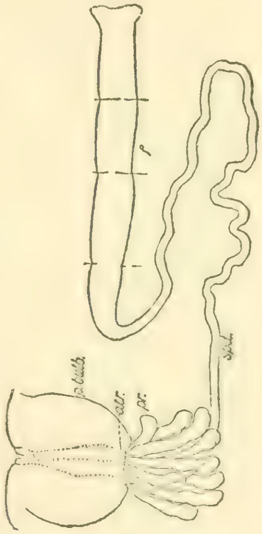


FIG. 6. *Mesenchytræus harrimani.*

Setchell, August 10, 1899, on the island of Unalaska. From notes made by the collectors it appears that the specimens occur both under stones and in sphagnum moss. The specimens from Metlakatla and Lowe Inlet are not quite adult, so there will always remain some slight doubt regarding their identity. Outwardly they resemble the type specimens from the other localities.

Characteristics. — With one exception, the largest *Enchytræus* which has come under my notice resembles in size a veritable *Allolobophora*, but possesses the general color of an Enchytræid. Form and size of spermathecæ and sperm-funnels the most characteristic features.

DETAILED DESCRIPTION.

Brain (fig. 4*c*). — Retractor muscles in three pairs; the two posterior ones cover the whole posterior margin of the brain.

Nephridia (fig. 4*a*). — Nephridia large, the ducts are not very distinct in the specimens, probably the effect of the formalin preservative. In the posterior lobe the duct seems to form a wide sinus (fig. 4*a*, *s*). At the base of the duct and close to the pore there is a widening of the duct, forming a kind of urinary bladder, from which the duct is branched and repeatedly coiled. No similar structure has come under my observation in any other species. The form of the nephrostome is illustrated by Pl. II, figs. 2 and 3, and requires no further description. The nuclei of the nephridia in all my formalin material are so completely unstainable that they cannot be satisfactorily located.

Atrium (Pl. II, fig. 4). — The structure of the atrium offers several points of interest. The cells lining the lower part of the sperm-duct are unusually narrow (Pl. II, figs. 1, 5 and 6). Between them may be seen the very thin ducts of the unicellular atrial glands (Pl. II, fig. 6). These tips penetrate the lumen and hang down into it like cilia. This protrusion of the glandular ducts is more evident on the surface outside of, but close to, the spermiducal pore. Here the epithelial cells are larger and, as they are not ciliated, the protruding ducts are more readily observed. It is probable that a similar arrangement is found in many species with atrial glands, and that only the smallness of the specimens has prevented a correct observation. The tips of the cells are readily mistaken for cilia or loose spermatozoa. In many instances the epithelial cells lie so close together that the tips of the ducts cannot be seen, except with the highest magnifications. In different parts of the lower portion of the sperm-ducts the epithelial cells are of a somewhat different structure. Thus at a point marked 'xx' the cells are longer and closer together (pl. II, fig. 1). The unicellular glands open partly inside the atrium, all along the surface marked 'xx' and 'xxx.' Partly also on the free, exterior surface marked 'x' in pl. II, fig. 5. The cytoplasm of the epithelial cells in question is striated, making it still more difficult to distinguish the free cell-tips, especially in indifferently fixed material.

Spermathecæ (figs. 4*d* and 5). — Spermathecæ unusually elongated, extending as far back as somites X or XI. In each somite there is a bulging out of the ampulla, each such sac-like part being separated from the one in the adjoining somite by the constriction caused by the septum. The last two swellings of the ampulla are larger than the others, as wide as the funnels of the sperm-ducts. No connection with the intestine. The spermathecæ resemble greatly those of *M. franciscanus*, except as regards the diverticles, which in *M. harrimani* are heavier and not as long.

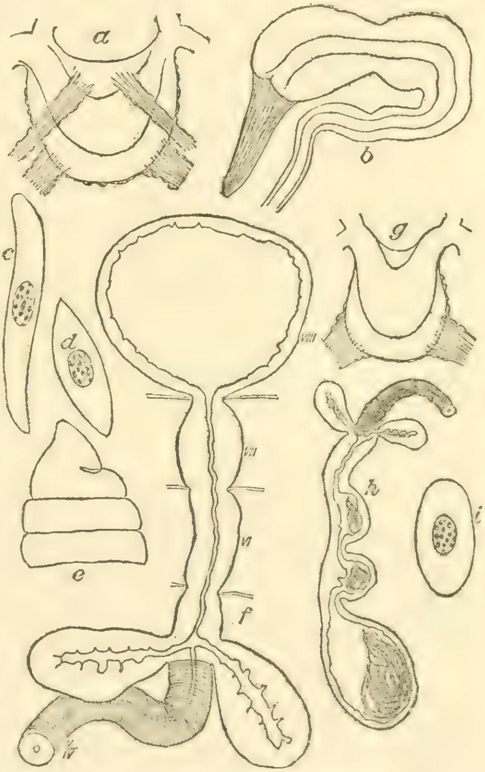


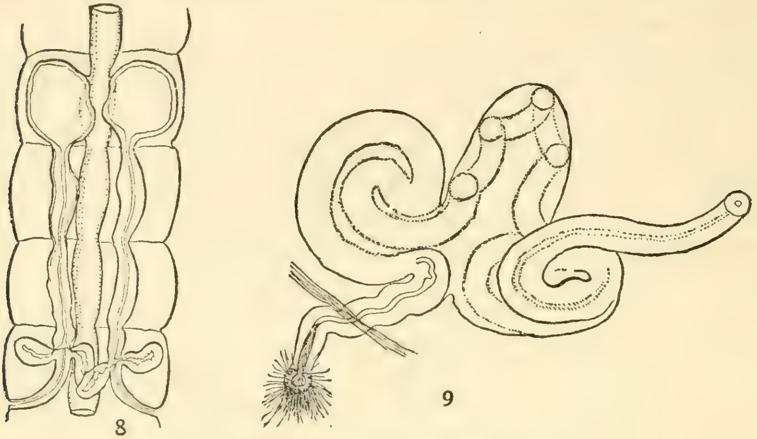
FIG. 7. *Mesenchytræus setchelli.*

MESENCHYTRÆUS SETCHELLI sp. nov.

Pl. I, fig. 11; pl. IV, figs. 1–3; and text-figs. 7–9.

Definition. — Length 12 mm, width .8 mm. Somites, 70. Prostomium pointed. Setæ: laterals, 4, 4, 4, 3, 4, 5, 3, 5, 4, 4, 0 (XII), 2 (XIII), 4, 4, 3, 3, 4, 4, 4, 4, etc., 3, 2, 3, 2; ventrals, 4, 5, 6, 7, 7, 7, 6, 5, 5, 5, 0 (XII), 5 (XIII), 5, 5, 4, 5, 6, 6, 6, 4, 5, 4, 4, 4. Setæ facing the lateral interval smaller; increase gradually in size toward the ventral and dorsal intervals. Clitellum ½ XI to XIII, with deep intersegmental grooves. Sexual papillæ small. Septal glands large, in IV to VI. Brain anteriorly deeply concave, posteriorly convex;

very thick and swollen. Dorsal vessel rises in XVIII. Intestine very gradually increases in size. Spermathecæ strongly bent, at the lower one-fourth furnished with two ovoid diverticles with thick epithelium. The ampulla very long and the apex swollen and globular; not connected with the intestine. Sperm-ducts about eight times as long as the funnels, which latter are contracted at the middle. Atrium with five atrial glands. Penial bulb with one set of glands, confined to the interior of the bulb. Two long sperm-sacs extending at least as far as XVIII. One ovisac. Nephridia with three large lobes; the anteseptal narrow and tubular. Lymphocytes ellipsoidal and pointed. Color white.



Figs. 8 and 9. *Mesenchytræus setchelli.*

Locality. — Unalaska Island, August 10, 1899, Prof. W. A. Setchell. Eight specimens.

Characteristics. — The most prominent character is the unusually long spermathecæ which extend through several somites, ending in VII or VIII; and which do not connect with the intestine. The ampulla contains numerous spermatozoa and is so large that it fills the whole available space in the somite.

DETAILED DESCRIPTION (figs. 7, *h* and 8).

Spermathecæ. — To the above description of these organs only a few points need be added. The part connecting the diverticles and the ampulla bulges out in places and shows several smaller pouches, in which also balls of spermatozoa were found. The presence of these smaller pouches is however not constant, as they were not found in two of the spermathecæ. The wall of the spermatheca is thick in the lower part, that is, from the ampulla to the pore, but the ampulla itself is very thin-walled. In two specimens the ampullæ rest in VIII, in another specimen they are situated in VII.

Atrial glands (pl. IV, fig. 3). — There are five atrial glands opening into the atrium. All possess long ducts, which in some of them run far down into the penial part of the atrium, while others open more directly. There are no circular muscles outside of the main muscular bulb, but inside the bulb such muscles are seen to surround each group of ducts.

Penial bulb (pl. IV, fig. 1). — The bulb contains two kinds of glands distinguished by stronger or weaker staining reaction. In the figure the more strongly stained glands are dotted. There are no accessory glands. The inner glands are all narrow, only one or two cells wide.

MESENCHYTRÆUS FRANCISCANUS sp. nov.

pl. IV, figs. 4, *5b*, *5c*, *5d*, *5e*, and *5f*; and text-figs. 10 and 11.

Definition. — Length 20 to 30 mm., width 1 mm. or over. Somites about 78. Body strongly tapering toward both ends. Setæ: laterals, 2, 2, 2, 2, 3, 3, 3, 3, 2, 3, 0, 2, 2, 3, 2, 3, 3, 3; ventrals, 5, 5, 5, 5, 4, 5, 6, 6, 5, 5, 0, 5, 5, 6, 5, 4, 5. The most ventral setæ in the ventral fascicles the largest. Clitellum prominent, $\frac{1}{2}$ XI, XII, $\frac{1}{2}$ XIII. Sexual papillæ small, a large projectible penis, containing the pore of a single large accessory gland. Septal glands IV to VI. Brain posteriorly straight; posteriorly much narrower than anteriorly. Dorsal vessel rises in XVI. Intestine with chloragogen glands. Spermatophores present in the cœlom. Spermatheca unusually enlarged, extending to X or XII; not connected with the intestine, but terminating in a closed ampulla; the lower part of the spermatheca with two narrow diverticles. Sperm-funnels large; sperm-ducts short, but very narrow; some eight small globular atrial glands opening into the atrium. A single large accessory gland penetrating the penial bulb and opening on a penial projection. Penial bulb contains several small globular glands opening near the pore. Nephridia with two large lobes. Lymphocytes small, pointed, or oval. Color pale lemon yellow. Blood deep orange yellow.

Locality. — Under decayed leaves and decaying bark of large lupins, in the wash of the creek entering Laguna Puerca, in San Francisco, California. Adult only in November to January. In February the sexual organs have completely degenerated.

Characteristics. — One of the best defined species. Not only is it strongly characterized by its enormous spermathecæ, but also by the large accessory gland-complex opening through the penial bulb onto an external penis, independent of the sperm-ducts. The blood is deep orange. This is also the color of the blood of *M. fontinalis* and *M. grandis*, these three species being the only ones of this genus which I have examined alive.

DETAILED DESCRIPTION.

Spermathecæ (fig. 11*d*). — The large sac-like part of the ampulla, which extends through many somites, is bent at a right angle against the lower part, which carries the diverticles. For the sake of clearness this is not shown on the figure. In four specimens sectioned and in two dissected the spermathecæ agreed as regards form. In length they varied, some ending into XI, others in XII.

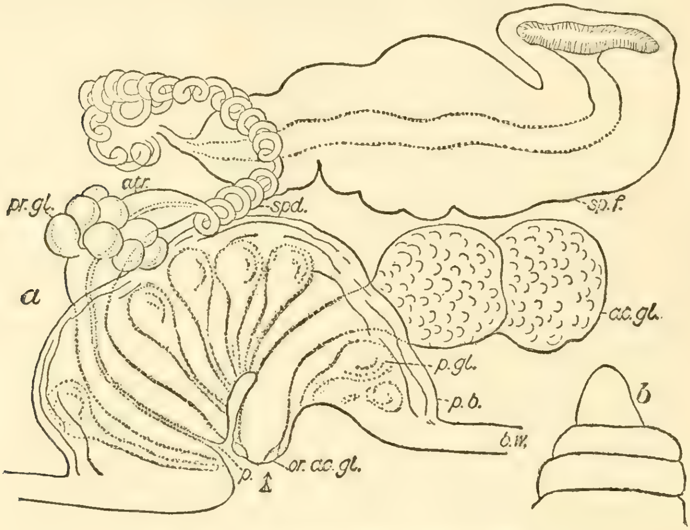


FIG. 10. *Mesenchytræus franciscanus.*

Spermiducal apparatus (pl. IV, fig. 4, and test-fig. 10 *a*). — Funnels large, extending either backward or forward through two somites, nearly straight, and about 12 times as wide as sperm-duct. Spermduct not much more than 1½ times as long as the funnel; much twisted and difficult to measure. Atrium has the usual form. The part inside the bulb about equal in thickness to the part outside the bulb. In the latter open some eight or more small globular atrial glands. These do not penetrate the penial bulb, but open in a circle all around the equatorial of the atrium. The most characteristic part of the efferent apparatus is the large accessory gland already described. This gland, which consists as usual of a complex system of unicellular glands, opens by a large and prominent duct into a special penis, which projects far outside the spermiducal pore. In Pl. IV, fig. 4, the section of the body passes through the two accessory glands. The atria and spermducts would be cut by sections posterior to this one. The inner lumen of the atrium and the lower part of the sperm-duct or penis proper are lined by large cubical cells, between which the narrow ducts of the atrial glands open. The penial bulb contains a number of the usual glands, separated by muscular fibers and connective tissue. In diameter these glandular masses are about equal to the diameter of the atrium.

Nephridia. — These organs are thick and the ducts could not be properly followed. Figure 11*b* represents the average form.

Spermatophores (figures in text). — In my earliest paper on Enchytræidæ (Eisen, 13) I gave it as a characteristic of *Mesenchytræus* that the spermatozoa were encysted when they entered the sperm-funnels. This was found to be the case in all the three species described at that time. In the majority of species of this genus no similar structures have been seen, though Michaelsen has mentioned them (Michaelsen, 4, p. 32) as existing in *M. beumeri.* In some ten or more species of this genus so far investigated by myself, no encysted spermatozoa have been found, but in *M. franciscanus* we find them present in large numbers. As Michaelsen has stated, the testes seem to break up in smaller parts. These smaller parts consist, in *M. fran-*

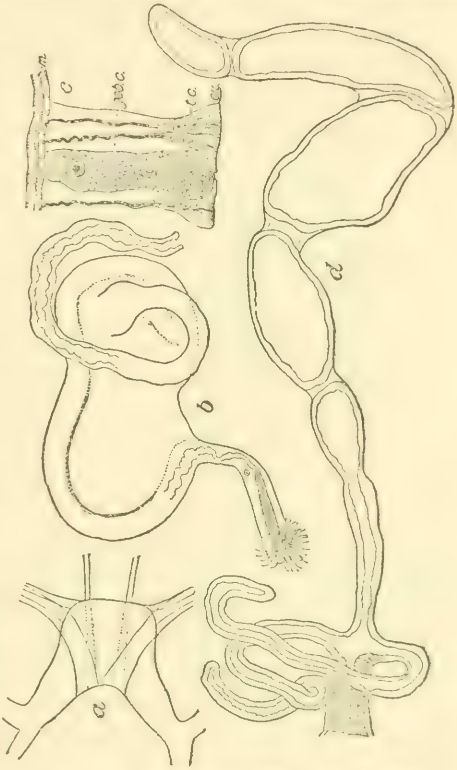


FIG. 11. *Mesenchytræus franciscanus.*

ciscanus, of large nurse-cells, upon which are arranged the minute spermatids in the shape of small globules scattered over the surface. In the earliest stage there is no sign of tails. The nurse-cells (with their charges) to the number of twelve or less are crowded together into a little ball, which is surrounded by a distinct membrane. These cysts or spermatophores begin to develop before they enter the sperm-sacs, but the finishing stages of the spermatozoa are brought about in the sperm-sacs. The cysts are found in the somites anterior to the funnels, but no cysts were found either in the funnels or in the spermathecæ. In *M. mirabilis*, as well as in *M. falciformis*, the cysts were found in the funnels. While thus spermatophores are in no wise characteristic of the genus, still they actually occur in several species.

MESENCHYTRÆUS OBSCURUS sp. nov.

Pl. VI, figs. 1 and 2; and text-figs. 12 and 13.

Definition.—Length 22 mm., width 1.75 mm. Somites 78 to 91. Setæ sigmoid: laterals, 5, 4, 3, 3, 3, 4, 3, 3, 4, 3, XII, 3, XIII, 4, 4, 4, 4, 4, 4 (3, 2); ventrals, 10, 10, 10, 10, XIII, 7, 9, 8, 7, 6, 6, 6, 6, (4, 2). Head-pore at apex. Prostomium small, pointed. Clitellum XII and XIII. Copulative papilla small. Septal glands IV to VI. Dorsal vessel rises in XV. Intestine surrounded by chloragogen cells. Spermathecæ very large, with two diverticles near the base. The ampulla long and several times folded on itself; walls very thin. Sperm-ducts long, extending backward as far as XVII, about 8 times as long as the funnels. Sperm-funnels slender, with a long recurved rim. Atrial glands from 16 to 20, grafted on the atrium. Large penial glands inside the penial bulb, opening close to the penis. Smaller glandular cells inside the penis. Sperm-sacs large, extend backward beyond IX, X, filling the cœlom. Lymphocytes minute, ovoid. Nephridia with three deep lobes. Color dark brown to yellowish brown.

Locality.—St. Paul Island, Pribilof group, also Popof Island, Alaska, July, 1899, Prof. Trevor Kincaid.

Characteristics.—This species is closely related to the California species *M. fuscus*, but differs in its larger size, in its very dark color due to masses of pigment, and in a larger number of atrial glands opening into the atrium and through its very large but thin spermatheca, which fills the whole available space in the cœlom. The number of setæ is greater in *M. obscurus*.

DETAILED DESCRIPTION.

Body-wall.—The layers of the body-wall thick, the general color so dark that no interior organs can be made out except by dissecting.

The color due to thick layers of pigment found principally in the longitudinal muscular layer as well as in the membrane lining the cœlomic cavity. Color varies with the specimens, some a deep chocolate brown, others yellowish or reddish brown. All have a lighter clitellum. (Alcoholic specimens.)

Brain (fig. 12*b*). — The brain is anteriorly deeply emarginated; it is broad and short.

Dorsal vessel. — Like the intestine, covered by a thick layer of chloragogen glands of a dark brown color.

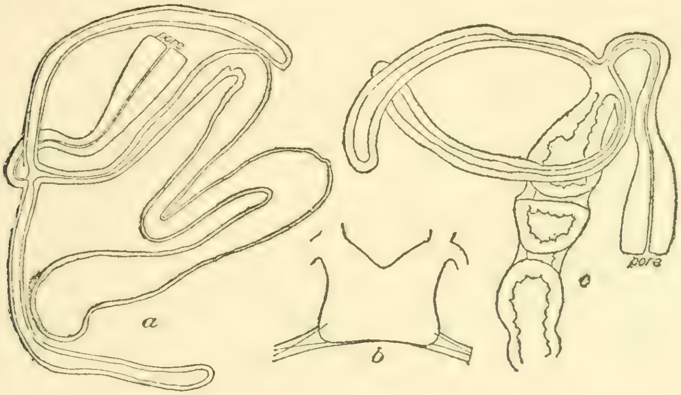


FIG. 12. *Mesenchytræus obscurus.*

Spermathecæ (figs. 12*a* and 12*c*). — The spermathecæ, on account of their great length and twisted nature, were not dissected out entire, and the figures are composed from two or three broken pieces and are accordingly not quite so satisfactory as could be desired. But from a comparison with the sectioned specimen it seems that the form is fairly correct as given. The unusually elongated ampulla extends back to somites IX or X. It is more or less folded, and does not seem to connect with the intestine. The spermathecæ are so large that they do not lie abreast, but one is pushed much farther ahead than the other. Thus while one spermatheca had its ampulla strongly folded in somites VI and VII, the other extended to somite X.

Atrial glands (fig. 13*c*).— I counted variously 16 to 20 atrial glands. They are grafted on the atrium, surrounding it on all sides, but are more numerous on one side than on the other. They enter the atrium as in *M. fuscus*, but are not surrounded by the circularly twisted muscles found in that species. These atrial glands are free in the cœlom. Enclosed in the penial bulb we find a number of penial glands similar to those found in *M. fuscus*, but more numerous. The lower part of the penis contains a few long glands enclosed within the penial sheath.

The *sperm-sacs* seem unusually large and extend beyond somite XVIII.

The *lymphocytes* were poorly preserved and their exact shape could not be made out, but they appeared oval and very small.

Nephridia (fig. 13*a*).— More deeply lobed than in any other species, the ducts unusually large, even for a *Mesenchytræus*. The nuclei all round. The inner lumen irregular and wide with a large number of wide chambers. The windings shown in the figure are only approximately correct. Not all the nuclei are figured, as many would not stain.

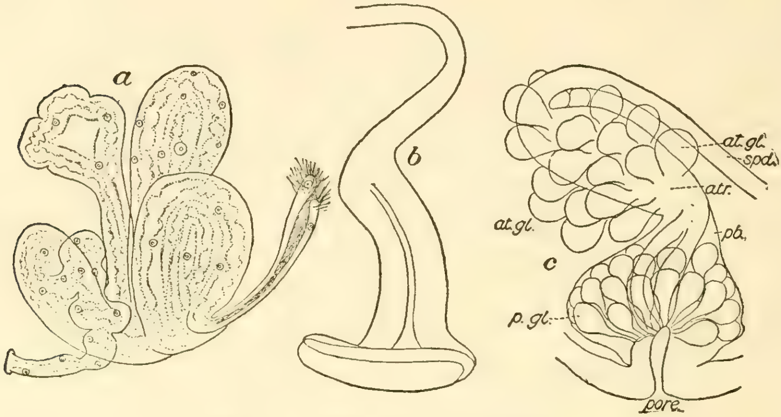


FIG. 13. *Mesenchytræus obscurus.*

MESENCHYTRÆUS MACULATUS sp. nov.

Pl. V, figs. 1–5; and text-fig. 14.

Definition.— Length 45 to 60 mm., width 1.3 mm. Somites 93. Head-pore far forward. Setæ: laterals, 2, 3, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 2, 3; ventrals, 6, 8, 8, 8, 8, 8, 7, 6, 7, 7, 0, 6, 6, 6, 6, 6, etc., diminishing in size towards lateral interval. Clitellum IX, XII and XIII. Sexual papillæ small, white. Brain deltoid, posteriorly slightly emarginated. Dorsal vessel rises posterior to clitellum. Intestine with a thick layer of brown chloragogen cells. Spermathecæ unusually enlarged, with two tubular diverticles at the center of the duct; the ampulla at first wide, doubled on itself, then narrower, extending to VII or VIII; does not connect with the intestine. The spermathecal pore surrounded by a large circular white field, exceedingly prominent. Sperm-ducts narrow. Sperm-funnels of medium size. Atrium with several atrial glands opening into the lumen outside the penial bulb. The penial bulb with many large penial glands (complex) opening around the penial pore; also numerous single glandular cells. A set of smaller glands, confined to the inner and lower part of penis, open in the penial lumen at the pore. Sperm-sacs large, double, extending far back. Spermatophores present in the sperm-sacs, but not in the spermathecæ. One ovisac. Nephridia large, two-lobed, with some inner ciliated ducts. Lymphocytes small, ovoid or ellipsoidal; cyanophil with erythrophil nucleus. Color dying yellow, with the anterior somites deep brown dorsally, due to pigment.

Locality.—Popof Island, July 13, 1899, Prof. Trevor Kincaid.

Characteristics.—This species resembles greatly *Mesenchytræus obscurus*, but differs in the following particulars: In *M. maculatus* nearly all the atrial glands open in the same plane, and the terminals of the ducts open in pockets between the epithelial cells. The brain is deltoid. In *M. obscurus* the atrial glands open, each one, almost, in a different plane, and the terminals do not open in pockets. The brain is broader than long. In *M. obscurus* the diverticles of the spermathecæ are much longer in proportion to the balance of the organ than in *M. maculatus*. In *M. obscurus* the large shield around the spermathecal pores is wanting. The two species are undoubtedly distinct, though closely related.

DETAILED DESCRIPTION.

Body (pl. v, fig. 4; and text-fig. 14 *a*).—The upper parts of the anterior somites strongly brownish, much more than appears from pl. v, fig. 4, the manner of illustration not permitting of sufficiently heavy shading. The head-pore an oblong, narrow, transverse slit, situated near the apex of the prostomium. The body strongly tapering posteriorly. Besides the general pigmentation of the anterior somites, several parallel brown lines reach from head to tail. Four of these lines run along and surround the fascicles of setæ, the two other lines passing through the spermathecal pores. All through the body there is much pigment deposited in the peritoneum.

Brain (fig. 14 *c*).—Only two posterior retractor muscles, but anteriorly two muscles extend toward the apex of the prostomium.

Clitellum.— The clitellar cells small, narrow, and not prominent; extend all around the body. The clitellar cells and the transverse layer of muscles together equal in thickness the longitudinal layer of muscles. All through the body the longitudinal layer is unusually developed. Outside of the clitellum the epithelium and the transverse layer measure one unit each, while the longitudinal layer alone measures thirteen units.

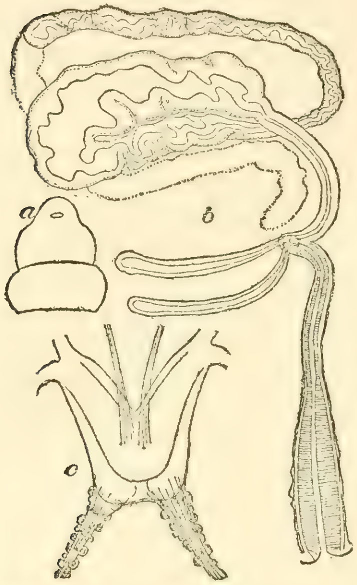


FIG. 14. *Mesenchytræus maculatus.*

Spermathecæ (fig. 14*b*). — Only one specimen dissected. Both spermathecæ found to be of the same size and form, and there is every reason to believe the form constant, and that the folding of the thick part of the ampulla against the narrow part is characteristic of the species. In one of the spermathecæ the apex of the ampulla is narrow and cylindrical, while in the other spermatheca the apex (from the place marked with a +) is thicker and irregular. The folded parts of the spermathecæ were alike in both organs. The ampulla extended backward to somite VI. I could not find any connection with the intestine. The diverticles equal in length the narrowest part of the duct. In one specimen the narrow apical part of the ampulla was much longer than in the other specimens, equalling in length the remainder of the spermatheca. This is indicated by a dotted line in the figure (14*b*).

Efferent apparatus. — As only transverse sectioning was made the relative proportions of the various organs could not be ascertained. Funnels folded on themselves have a flaring lip. Diameter of the sperm-duct equal to one unit, diameter of the atrium equal to three units. Ducts relatively very narrow, confined to the clitellar somites, in which they are considerably coiled.

Atrial glands (pl. v, fig. 5). — At least 12 atrial glands opening into the atrium in the same horizontal plane, immediately outside of the penial bulb; all large, about three times the diameter of the atrium. There may be a few more glands opening into the atrium at a lower plane, immediately below the first one. The individual cells of these glands are large and contain large eosinophil granules (in the figure black). Their ducts are, as usual, long and narrow. They penetrate the atrial wall, surrounded by circular muscles. After entering, a few of them seem to spread out, but the majority remain bunched together, and enter in this manner between the epithelial cells of the atrial lumen. Here the ducts open their contents of eosinophil granules into pockets of large size. These pockets may readily be mistaken for cells, but favorable cuts show that they are entirely independent of the cells, that they do not contain nuclei, and that they stand in direct connection with the ducts from the glands. Pl. v, fig. 5, which represents a cross-section of the atrium just above the penial bulb, is slightly diagrammatic. There should be a great many more of the large black granules in the chambers, but, in order not to obscure the drawing too much, comparatively few have been shown. The granules are all perfectly globular, but vary somewhat in size, the majority being large. In many places they are seen to be ejected into the atrial lumen.

Penial chamber (Pl. v, fig. 2).— Inside the penial bulb the lower part of the sperm-duct is enlarged, forming a penial chamber. This chamber is lined by cubical epithelial cells, between which some ducts from atrial glands seem to open. The lower part of the penial chamber is lined by narrow glandular cells with very fine granulation and with rather large oblong nuclei. The outermost of these cells are different from the rest, having longer and narrower nuclei. They also stain a little deeper.

Penial glands (Pl. v, fig. 2).— The glands properly designated penial glands, and confined to the interior of the penial bulb, are of two kinds. The regular penial glands, collected in large bunches, open as usual on the surface surrounding the pore. There are, besides these glands, also a large number of single glandular cells opening into the walls of the penial chamber. They can be clearly seen to penetrate between the muscles of the wall.

Nephridia (Pl. v, figs. 1 and 3).— The nephridia are unusually interesting, not so much on account of their form, but because of their similarity to the nephridia of the higher terrestrial Oligochæta. This similarity consists in a network of interlacing ducts, situated immediately below the nephrostome. The network of ducts, considerably finer than figured, soon collects into the outermost canal of the nephridium, the lumen of which duct is quite narrow. Another characteristic of the nephridium is the presence of ciliated ducts. The exact location of these ducts it is not possible to determine at present, but they are certainly situated in the center of the windings, and do not connect either immediately with the nephrostome, nor with the posterior duct. There are at least 19 nuclei in a nephridium, not counting the row situated transversely in the nephrostome.

MESENCHYTRÆUS VEGÆ sp. nov.

Pl. III, figs. 1 and 2; text-fig. 15.

Definition. — Length 20 mm., width about 1 mm. Somites 85. Prostomium pointed. Setæ sigmoid; ventrals: 7, 8, 8, 8, 8, 9, 7, 7, 7, 8, 7, 0, 6, 6, 6.........5, 5, 4, 4, 3; laterals: 5, 5, 5, 5, 6, 5, 4, 4, 4, 4, 0, 4, 3, 3. Sexual papillæ not prominent. Brain broader than long, anteriorly and posteriorly emarginated. Intestine with chloragogen cells. Spermatheca very large, extending through several somites, connecting with the intestine by a very narrow duct in VII or VIII; two diverticles; the ampulla inflated, sigmoid, tapering to the apex. Sperm-ducts narrow and comparatively long. Atrium and penis, which are wide, connected by a narrow part. About 12 to 14 atrial glands opening in the atrium in the same horizontal plane. Penial bulb with one kind of gland, about four or five in the same plane. No accessory glands. A thin but dense layer of pigment in the peritoneal membrane. No other pigment. Color of the single specimen dark yellow.

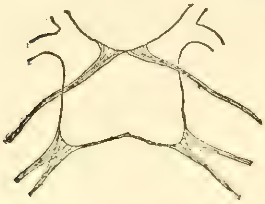


FIG. 15. *Mesenchytræus vegæ.*

Locality. — Port Clarence, Alaska. Collected by Dr. Anton Stuxberg, July 27, 1878, Vega Expedition. Owing to the fact that the collection contains only a single specimen of this species, the description is necessarily meager. The characteristics, however, are so prominent that the species cannot be confounded with any others so far known.

Spermathecæ (Pl. III, fig. 2). — The most characteristic feature concerns the spermathecæ. As the accompanying figure fully illustrates the structure of these organs no further description is necessary. Their structure places this species in the same group as *M. harrimani* and *M. setchelli*, in which species the spermathecæ are unusually large, connecting with the intestine in a somite posterior to V. These species are all characterized by the inflated distal part of the spermathecal ampulla.

Spermiducal apparatus (Pl. III, fig. 1). — Penial structure and atrium characterized by the narrow part connecting them; narrow part about one-half the diameter of the atrium. Atrial glands surrounded by circular muscles at their entrance into the atrium; all in the same, or in almost the same plane, so that a single horizontal section will cut them all at the same relative point. The narrow ducts of the atrial glands do not seem to enter the lumen of the atrium and penis, but continue down to the penial pore. Glands in the penial bulb large, and rarely more than four visible in the same section.

MESENCHYTRÆUS ORCÆ sp. nov.

Pl. XI, figs. 1 and 2; text-fig. 16.

Definition.—Length 6 mm., width .5 mm. Somites 33. Prostomium large, round. Head-pore near apex. Intersegmental grooves deep on ventral side. Clitellum $\frac{1}{2}$ XI–XIII; clitellar cells unusually large. Body entirely transparent. Setæ: laterals, 4, 4, 4, 3, 4, 4, 4, 4, 4, 4, 3, 3, 3, 3, 4, 4, 3, 4, 4, 3, 3, 3; ventrals, 5, 6, 6, 7, 6, 6, 5, 5, 5, 5, 0, 4, 4, 4, 4, 5, 4, 4, 4, 4, 5, 3, 4, 5, 4. Sexual papillæ small. Septal glands in IV to VI. Brain longer than broad, posteriorly truncate, anteriorly deeply cleft. Dorsal vessel rises in XV. Intestine with a few chloragogen cells. Spermathecæ unusually enlarged, consisting of an exceedingly long and slender duct with two minute globular diverticles at the center, and a long and thick terminal ampulla extending as far back as X; no connection with the intestine. Funnels not above average size. Sperm-ducts about twice as long as the funnels. Penial bulb narrow, without any penial glands. A set of several large glands pierce the penial bulb and enter the lower part of the sperm-duct just above the pore. No accessory glands. Nephridia with several deep lobes. Lymphocytes disc-like, not large. Color white, no pigment.

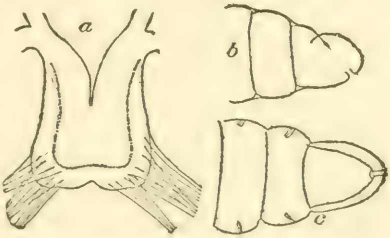


FIG. 16. *Mesenchytræus orcæ.*

Locality.—Orca, Alaska, June 25, 1899. Collected by Prof. Trevor Kincaid. Two specimens found under rocks on the seashore, above high tide. Also a few specimens from Yakutat, Alaska.

Characteristics.—Not only is the shape of the spermathecæ characteristic of the species, but the large atrial glands, which enter the sperm-ducts at the pore inside the penial bulb, distinguish this species from all others in the group with enlarged spermathecæ.

DETAILED DESCRIPTION.

Body-wall.—The body-wall thin and entirely transparent, without any pigment in any of the layers. The goblet cells in the clitellum large and square and very prominent, giving the clitellum, when viewed exteriorly, a strongly mottled or marbled appearance.

Testes.—Consist of a number of narrow lobes, as in *M. mirabilis.* Sperm-sacs extend as far back as XIV and ovisacs as far as XVII.

Spermathecæ (pl. XI, fig. 1).—Some variation in the size of the various parts. The duct with its small globular diverticles was in one specimen equal in length to the ampulla. In the other specimen the ampulla is much longer and more strongly nipped by the septa. In one specimen the ampullæ extended as far back as VIII, but in the other they reached IX.

Spermiducal apparatus (pl. XI, fig. 2).—The penial bulb hardly encloses any more of the sperm-duct than the pore, at any rate it does not ascend along the duct as in most species. Immediately adjoining the bulb, or in the upper part of the bulb, the atrium is joined by a set of five or more atrial glands. Penial bulb with no glands of any kind; large glands outside of the bulb extend in all directions around the bulb a distance equalling the diameter of the bulb. Atrium itself only a little wider than the sperm-duct. The length of the sperm-duct could not be ascertained, as there was no specimen to dissect, but judging from sections in which it is seen that the ducts do not extend farther back than XIII, it can be concluded that the ducts are not over twice as long as the funnels.

MESENCHYTRÆUS KINCAIDI sp. nov.

Pl. I, figs. 16 and 17; pl. VII, fig. 7; text-fig. 17.

Definition.—Length 21 mm., width .85 mm. Somites 67. Setæ sigmoid: ventrals, 4, 5, 6, 7, 8, 6, 7, (XIII) 3, 6; laterals, 3, 4, 5, 4, 3, 4 (XII), 13, 4, (2, 2). Prostomium small, somewhat pointed, somite I short. Clitellum XI, XII, XIII, prominent. Copulatory papilla exteriorly not prominent. Septal glands in IV to VI deeply lobed and consisting of several folds. Brain anteriorly very deeply emarginated, posteriorly convex, broader than long. Dorsal vessel rises posterior to somite XV. Intestine covered with a layer of short thin chloragogen cells. Spermathecæ stout, with two diverticles almost as long as the whole spermatheca. Sperm-ducts extend as far back as XVII, thin, but at least seven times as long as the funnels. No atrial glands, no accessory and no penial glands of any kind. The penial bulb consists exclusively of muscular tissue, and contains no glands. Sperm-funnels are thin and long, and doubled on themselves. Both testes and ovaries are lobed. The testes are connected with each other ventrally. Sperm-sacs are thin, entirely confined to the ventral side of the cœlom. Lymphocytes are small, elongated ovoid, numerous. Nephridia possess one lobe considerably larger than the other. Color gray. Whole body pigmented.

Locality. — Ice-House Lake, St. Paul Island, Bering Sea, Alaska. Collected by Prof. Trevor Kincaid, for whom I have the pleasure of naming the species.

Characteristics. — The most prominent character of this species is the complete absence of glands connected with the efferent apparatus. Even inside the penial bulb there is nothing but connective tissue and muscular strands surrounding the lower part of the sperm-duct.

DETAILED DESCRIPTION.

Septal glands. — In transverse sections of the body it is seen that the septal glands are much lobed and consist of two or three folds of unequal sizes. Each lobe is made up of a row of glandular cells along each margin.

Dorsal vessel. — So far as I can judge from a series of cross-sections, the dorsal vessel appears to rise in XV. It is thinly covered with very short chloragogen glands. A single row of similar short glands covers also the intestine. The epithelial cells of the intestine of about the same length as the chloragogen cells. A continuous blood-sinus in the intestine, at least in the clitellar somites.

Spermathecæ (fig. 17, *a*). — The junction of the spermathecæ and the intestine on the dorsal median line of the intestine. Muscular duct of the spermatheca short. The club-shaped diverticles are of the same length as the ampulla.

Sperm-ducts (pl. VII, fig. 7). — As in many Mesenchytræids, the sperm-ducts extend posteriorly through several somites, in this species as far back as XV. This would make the sperm-ducts about seven times as long as the funnel. They end at the place where the sperm-sacs suddenly widen out. Sperm-duct widens slightly as it enters the penial bulb; no atrium, as in some species, nor can I detect any glands connected with the penial chamber. The *penial bulb* consists of a thickening of the longitudinal muscular layer of the body and contains principally connective tissue interwoven with muscle fibers. When retracted it projects to or slightly beyond the center of the cœlomic cavity.

The sperm-sacs are at first very narrow — about as thick as the dorsal vessel. They widen out in XIV, but even posteriorly do not become wider than the intestine, or even as wide, and remain confined to the ventral part of the cœlom. They originate from the tips of the testes.

Body-wall. — Integument thick, especially the longitudinal muscular layer. The pigment not continuously distributed, but found in small patches, which latter are evenly distributed throughout the whole length of the body.

Nephridia (fig. 17*e*). — Not only is the outside form of the nephridia characterized by a long anterior lobe, but the canals differ also from those of Mesenchytræids generally. Instead of being of even thickness throughout and closely wound, the canals are most irregular, and furnished with a lumen which in places is very wide, and in other places very narrow. In places even the lumen widens out to form regular chambers. There is also a great deal of cellular matrix not belonging to the ducts, and this matrix contains larger and smaller vacuoles which probably stand in connection with the ducts. Near the posterior lobe, where the returning duct connects with the narrow duct leading to the pore, the return duct widens out more than anywhere else and its lumen forms a succession of chambers. These chambers and widenings of the lumen are not exactly similar in the various nephridia, but are subject to such variations that no two nephridia are entirely alike.

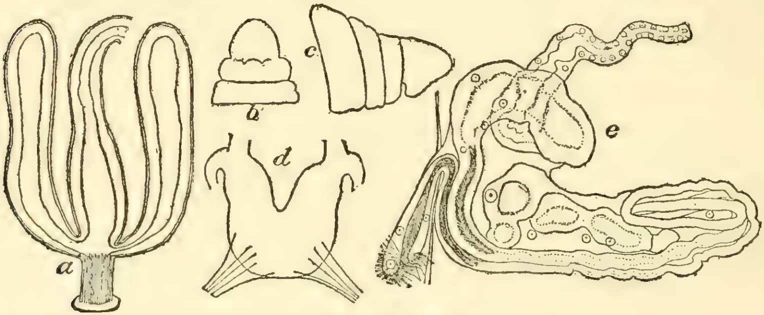


FIG. 17. *Mesenchytræus kincaidi.*

MESENCHYTRÆUS PENICILLUS sp. nov.

Pl. IX, figs. 1 and 2; text-figs. 18 and 19.

Definition.—Length 15 mm., width 1 mm. Somites 85. Prostomium small and pointed. Setæ: laterals, 4, 5, 6, 5, 4, 6, (XII)

3, (XIII) 5, 6, 5, 4, 5, 5, 6, 6, (5, 4, 3, 3, 2, 2); ventrals, 6, 7, 7, 7, 7, 7, 0, (XIII) 4, 7, 6, 5, 4, 5, 6, 5, 4, 3, 2. Head-pore far forward. Clitellum XII–XIII. Copulative papilla insignificant. Septal glands in IV to VI. Brain broader than long, posteriorly truncate. Spermatheca short and broad, lopsided, with two short diverticles at the center. Sperm-ducts short, as long as the funnels. Funnels long and narrow. Penial atrium long and rather narrow. Three or four long atrial glands enter this atrium outside of the penial bulb. Some five or six penial glands inside of the bulb opening near the penial orifice. Ovaries and testes in XII and XI. Two large and very long sperm-sacs connecting with the funnels extend backward some fifteen or more somites. Nephridia rounded, with shallow lobes. Nuclei slightly oval. Lymphocytes unknown. Color of alcoholic specimens pale yellowish.

Locality.— Port Clarence, Alaska. A single specimen, collected by Prof. Trevor Kincaid, August, 1897.

Characteristics.—This species is readily distinguished by the short spermathecæ, which are peculiarly lopsided, one diverticle being thicker than the other. The short sperm-ducts are also characteristic. Owing to want of specimens the detailed description given below is naturally meager. Part of the single specimen was dissected, part sectioned transversely. As will be seen, the species belongs to the group of Mesenchytræids with atrial glands. These glands are larger than in *M. fuscus*. They are also less numerous than in that species, its nearest relative.

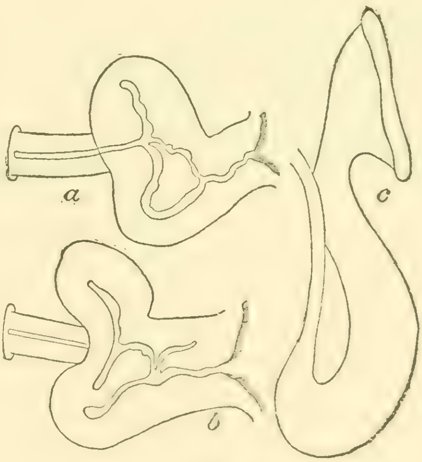


FIG. 18. *Mesenchytræus penicillus.*

DETAILED DESCRIPTION.

Spermathecæ (fig. 18, *a* and *b*).—Both spermathecæ showed a peculiar lopsidedness.

Sperm-ducts (PL. IX, fig. 2).—These are less than one-eighth as long as the funnel. The penial bulb extends nearly to the end of the atrial enlargement in the dissected specimen. In the sectioned half it appears to extend to the middle of the atrium.

The atrial glands push through the bulb, but their larger part lies free in the cœlom. There are five or six penial glands inside the bulb, opening around the penial pore. The *funnels* are (in the single specimen) engaged in the sperm-sacs. They are turned backward and lie in somites XII and XIII, instead of in IX, as is usually the case. The atrial glands seem to open mainly on the concave side of the atrium. Pl. IX, figs. 1 and 2, are somewhat diagrammatic, but represent correctly, in a general way, the spermiducal apparatus.

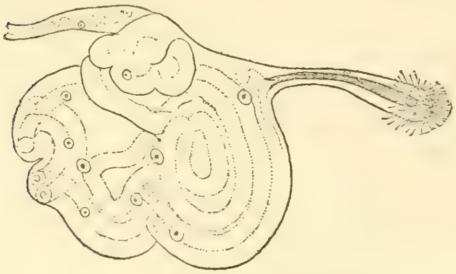


FIG. 19. *Mesenchytræus penicillus.*

Nephridia (fig. 19).—The outlines are rounded and the lobes quite shallow. The nuclei are nearly round and of different sizes. The *lymphocytes* are not known.

MESENCHYTRÆUS GRANDIS sp. nov.

Pl. I, figs. 8–10; Pl. VII, figs. 1–6; text-fig. 20.

Definition.—Length 170 mm., width behind clitellum 1.75 mm., clitellum 2.25 mm. Body strongly tapering, especially toward the tail. Somites 105. Setæ: ventrals, 3, 4, 5, 6, 5, 6, 6, 6, 5, 5, 0, XIII, 1, 5, 6, 6, 5, 5; laterals, 2, 3, 4, 4, 3, 4, 3, 4, 3, 0, XIII, 1, 4, 4, 4, 5, 4, 5. Clitellum very prominent. Prostomium rounded, with a large head-pore far forward. Sexual papillæ distinct, but not large; ovipores prominent. Septal glands in IV to VI. Brain posteriorly slightly emarginated, a little longer than broad. Spermathecæ thick, with two long club-shaped diverticles, as long as the duct, ampullar part short. Intestine and dorsal vessel covered with short but dense chloragogen cells. The dorsal vessel rises posterior to XX. Spermducts about three times as long as the funnels, which latter are unusually long, extending through some six somites backward. The lower part of the sperm-duct with a long and narrow atrium and a large penial bulb. In the atrium open some seven or eight long glands. Some twenty or more penial glands open around the base in the penial bulb. Ovaries and testes absent in the single specimen. Ovisac begins in XVII. Nephridia thick; broad anteseptal; postseptal with three folds; posterior duct thin, nuclei very small, ovoid. Lymphocytes of medium size, globular, with some six or more large and densely staining granules. Color pale citron yellow.

Locality.—In plants brought from Alaska (probably Sitka or Juneau). Presented by Mr. Alexander Craw. A single specimen which was carefully narcotized and fixed in sublimate.

Note.—The specimen having been received late in the year (Sept., 1897), the testes and ovaries had degenerated, as careful search failed to reveal any trace of them whatever. The sperm-sacs, on the contrary, are in a fully developed stage, and full of spermatozoa. The spermathecæ and the sperm-ducts are also in a highly developed condition, and show no sign of degeneration.

Characteristics.—Characterized by its spermathecæ, the diverticles of which are as long or longer than the duct, while the ampullar part is short. The sperm-ducts widen out to an atrium, the glands of which are comparatively long. The long ducts of the glandular cells are carried far down the sperm-ducts, opening into the duct all along its course down to the very pore. This species resembles greatly *M. harrimani*, and may be said to be *M. harrimani* with short spermathecal ampulla.

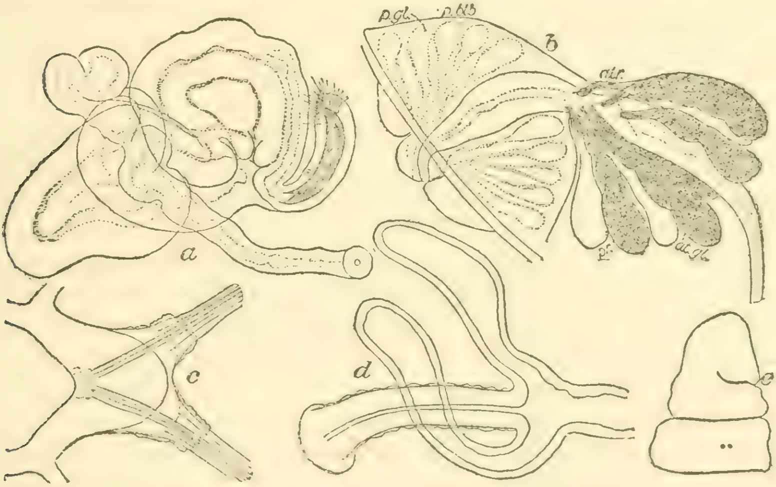


FIG. 20. *Mesenchytræus grandis.*

DETAILED DESCRIPTION.

Brain (fig. 20, *c*).—The posterior margin of the brain is so indistinct that it is impossible to say whether it is strongly concave or only slightly so. I have therefore dotted the line indicating the margin. This indistinctness is not due to any tearing in dissecting, but from the fact that the brain-cells are carried out on the powerful retractor muscles connecting the brain with the body-wall.

Spermathecæ are strong and rather contracted. They are of large size, even for a worm of the unusual size of our present species.

Sperm-ducts.—The funnels long and thin, and in the specimen turned backward. The ducts extend backward some six or seven somites, but on account of the length of the funnels are not over three times as long as the former. The most interesting part of the organ is, of course, the atrial part with its glands. There is a long and narrow atrium outside the bulb and a wider penial chamber within. The openings of the atrial glands are close to the penial bulb and close to each other. As has already been stated, the ducts of the individual cells, after entering the atrium, penetrate its inner layer all along down to the penial pore. The shape of the glands is also somewhat characteristic, being long and even and much less pear-shaped than those of the other species which have so far come under my observation.

Sperm-sacs.—The two usual sperm-sacs are present. They begin as far forward as somite VII, where they appear to spring from the septum VI/VII. They gradually increase in size posteriorly, except in the somites of the clitellum, where they are thin, even and tubular. The walls of the sperm-sacs are thick, a cross-section resembling a cross-section of a spermatheca.

Lymphocytes (pl. VII, figs. 3–6).—There are in reality two kinds of lymphocytes, one with cyanophil and one with eosinophil granulation. The cells may also be void of any granules, in which case one kind cannot be distinguished from the other. The cells are globular, rounded and mulberry-shaped, as regards outline. The cytoplasm is coarsely reticulate, the nucleus small. In cells with cyanophil granules, the latter are of even size and uniform shape, rather squarish and with blunt ends. There are from six to ten or more of these granules in each cell. The granules are quite separate one from the other. In the other kind of cell the granules are of all sizes, some very minute, others several times larger than the cyanophil granules. Of these eosinophil granules there are many more in each cell, sometimes as many as twenty or thirty. They are frequently thrown out in the cœlom, and are here found in all sizes, entirely free from the lymphocytes themselves. The eosinophils are by far the smallest of these two kinds of lymphocytes; the difference in size is however not great. As will be seen, even the lymphocytes resemble those of *M. harrimani* to such an extent that a close relationship exists between the two species.

For want of specimens of *M. grandis* this relationship cannot now be cleared up. It may be possible that *M. grandis* is identical with *M. harrimani*, the spermathecæ having become accidentally reduced.

MESENCHYTRÆUS FUSCUS sp. nov.

Pl. VIII, figs. 3–5; text-figs. 21–23.

Definition. — Length 15 mm., width 1 mm. Somites 58. Setæ sigmoid: laterals, 3, 3, 3, 3, 4; postclitellars 3, 3, 4, 4, 4; ventrals, 6, 6, 7, 7, 7, 6; postclitellars, 6, 6, 6, 5 (5, 3, 2). Head-pore large, near the apex. Clitellum, dorsally XI–XIII, ventrally ½ XI–XIII. Copulatory papilla of medium size. Intestine in II and III much narrower than in the following somites. Septal glands in somites III–VI. Brain posteriorly truncate, anteriorly deeply incised. Dorsal vessel rises in somite XX and at once is very thick. Spermatheca with two sausage-shaped diverticles nearer the pore than the intestine. The diverticles are about one-third as long as the whole spermatheca. Sperm-ducts about twelve times as long as the funnel, extending back some nine somites, or to XXI. Funnels very large, helix-shaped. An atrial chamber into which open independently of each other six to eight glands. Penial glands opening at the base of the sperm-ducts. Sperm-sacs very large, one pair extending as far back as somite XXVII or further. One ovisac. Nephridia with two almost circular lobes. Lymphocytes few, flat and circular.

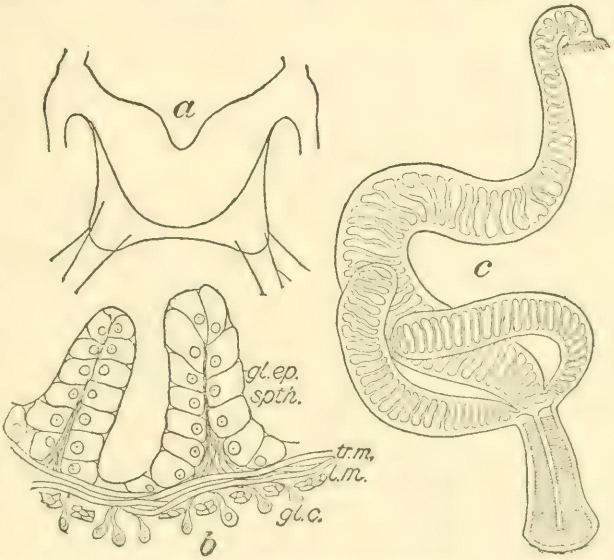


FIG. 21. *Mesenchytræus fuscus.*

Locality. — In moss in Pit River (below the falls), California. Also from several other localities in northern California. Collected by Dr. Richard C. McGregor.

Characteristics. — Externally this species is readily recognized by the tawny color of its anterior somites, especially their dorsal part, which color is caused by scattered granules of pigment. Internally the species is characterized by its six to eight comparatively large atrial glands, which open directly into the atrium (fig. 22, *a*).

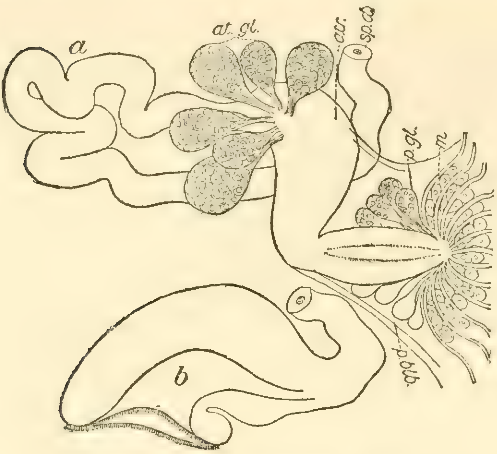


FIG. 22. *Mesenchytræus fuscus.*

DETAILED DESCRIPTION.

Pigment. — The granules of pigment are found in both the epithelial cells and in the circular muscular layer, but they are especially numerous in the outer part of the epithelial cells of the body-wall. Posterior to clitellum they are absent.

Head-pore is situated about half way between the apex and somite I.

Copulatory organ. — As in many species of *Mesenchytræus*, the part of the sperm-duct nearest the male pore possesses two chambers joining each other, the outer one being more properly a penis, while the inner one is of a more glandular nature (fig. 22, *a*). In this inner chamber and on the side nearest the intestine open the prostates. In the specimens dissected and sectioned there are some six to eight bunches of these atrial glands, each opening independently in the atrium. The distal end of each glandular fascicle is globular or pear-shaped, while the tubular end duct is narrow. This duct is composed of a mass of tubes, which jointly penetrate the atrium, forming a thick layer of tubes between the muscular and the glandular layers of the atrium (pl. VIII, fig. 5). The ducts of each fascicle surrounded by spirally wound muscles, which seem to be mere outcroppings of the outer muscular layer of the atrium. None of these glands open at the base of the penis. The penial bulb consists of muscular strands arranged

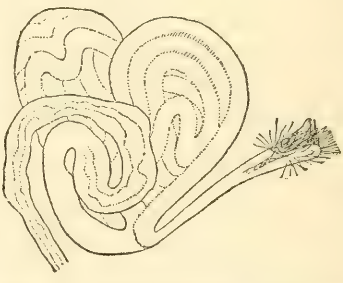


FIG. 23. *Mesenchytræus fuscus.*

as the spokes in a wheel, and between the strands are a number of small unicellular glands opening near the pore. Besides these very small glands, there are also a dozen or more larger glands which rise high above the muscular strands (pl. VIII, fig. 5), and which seem to open near to the apex of the penis. There are thus three sets of glands opening in connection with the sperm-ducts: atrial glands and two kinds of penial glands, the smaller of which do not rise above the muscular strand mentioned above. The funnels are thick and helix-like (fig. 22, *b*), and taper very gradually into the sperm-ducts. The sperm-sacs are long and thick, extending from the ventral to the dorsal side of the cœlom.

Nephridia (fig. 23) are round with two principal folds with rounded outlines. The duct leading to the pore is thick and helix-like.

Lymphocytes few in number, of disc-like form, and quite small.

Intestine.— The intestine, both posterior and anterior to clitellum, is covered with a thick coating of brown chloragogen cells.

MESENCHYTRÆUS FUSCUS INERMIS var. nov.

Pl. I, fig. 18; text-fig. 24.

Definition.— Length about 20 mm., width about 1 mm. Somites 75. Setæ sigmoid: laterals; 3, 4, 3, 0, 5, 6, 5, 6, 6, 7, 6, 5 (4, 3, 2); ventrals; 4, 5, 6, 5, 0, 6, 6, 4, 6, 7, 6, 5 (5, 4). Head-pore halfway between apex and the first groove. Clitellum ventrally and dorsally ½ XI–XIII. Sexual papillæ not large. Septal glands in IV to VI. Brain as in the species, but less emarginated anteriorly. Dorsal vessel rises in somite XXI. Intestine narrower in II and III. Spermatheca with two diverticles near the base, each being two-elevenths as long as the whole spermatheca. Sperm-ducts about twelve times as long as the length of the funnel. Funnel more slender than in the species. An atrium present, in which open four to six glands near its junction with the penis. Penial glands open near the penis. Sperm-sacs very large, extending as far back as XXII. Egg-sac extends at least to XXVIII. Testes and ovaries normal. Nephridia less round than in the species. Lymphocytes small and ovoid.

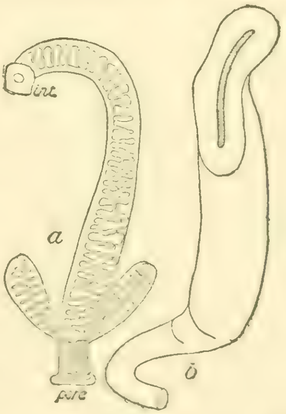


FIG. 24. *Mesenchytræus fuscus* var. *inermis.*

Locality.— West Fork of Feather River and Goose Lake, northern Modoc County, northern California, Dr. R. C. McGregor. Several specimens.

Characteristics.— This variety differs from the species in the shape of the spermatheca, and in the absence of pigment granules in the body-wall. There is also a difference in the form of the sperm-funnel and in the shape of the prostates, as will be shown below.

DETAILED DESCRIPTION.

I will only dwell upon points in which the variety differs from the species.

Body-wall. — There are no pigment granules in any of the somites. The specimens are white, those of the species being anteriorly strongly tawny.

Spermatheca. — The diverticles of the spermatheca (fig. 24, *a*) are much smaller than in the species, as a comparison of the figures will show. In the species the diverticles are about one-third as long as the whole spermatheca, while in the variety they are two-elevenths as long.

Spermiducal apparatus. — The atrial glands enter the atrium nearer the penial chamber than in the species. There is also a difference in the form of the glands, which in the variety are more oblong. In the species they are more rounded.

MESENCHYTRÆUS EASTWOODI sp. nov.

Pl. I, fig. 12; Pl. VI, fig. 3; text-fig. 25.

Definition. — Length 6 to 8 mm., width .6 mm. Somites 65. Setæ: ventrals, 6, 6, 6, 5, 6, 6, 5, 5, 6, 5, 6 (XII), 4 (XIII), 4, 4; laterals, 2, 2, 3, 3, 3, 3, 3, 3, 2, 2 (XII), 2 (XIII), 2, 2, 3, 3, 3, 2. The most lateral setæ in the ventral fascicles and the most ventral in the lateral fascicles are smaller. Head-pore on the upper side of prostomium, which is short, blunt, and rounded. Brain anteriorly deeply emarginated, posteriorly straight; longer than wide. Dorsal vessel rises posterior to XV. Intestine with small flat chloragogen cells. Spermathecæ with a pair of cylindrical diverticles at the center, each diverticle being a little shorter than half the spermatheca. Sperm-ducts about eight times as long as the funnels. Funnels small, almost globular, with twisted basal part. A comparatively narrow atrium exterior to the penial bulb. Two long and irregular atrial glands open in the atrium. Six or eight penial glands inside the bulb open at the penial apex. Two pairs of sperm-sacs well developed. Lymphocytes oval, with pointed ends, about one-fifth as long as the narrow diameter of the brain.

Locality. — Hoods Peak, Sonoma Co., California, April, 1893, in soil near a creek. Collected by Miss Alice Eastwood. Of some twenty specimens only a few are adult.

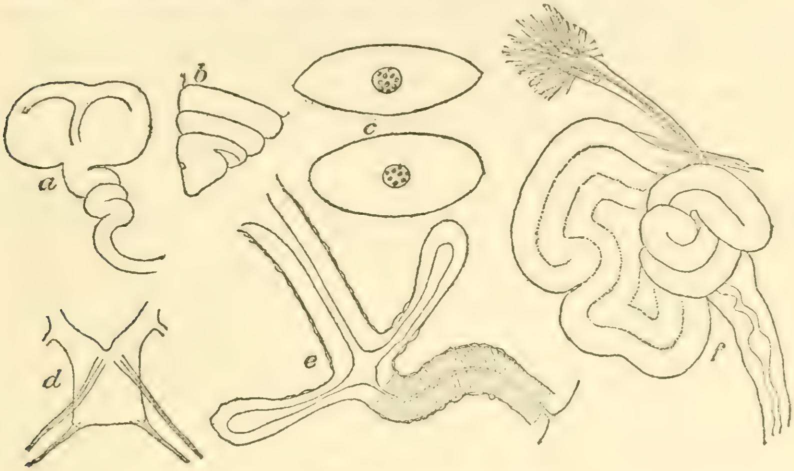


FIG. 25. *Mesenchytræus eastwoodi.*

In size this species resembles *M. fontinalis.* From this species *M. eastwoodi* is well distinguished by its atrial glands, its small lymphocytes, and the arrangement of its setæ, which gradually diminish in size toward the lateral interval.

MESENCHYTRÆUS NANUS sp. nov.

Text-fig. 26.

Definition.— Length 8 mm., width .6 mm. Somites 56, well defined. Setæ: laterals, uniformly 2, 2, etc., 1; ventrals, 3, 4, 4, 5, 5, 5, 5, 4, 4, 4, 0, 2, 3, 2, etc. Head-pore near apex. Sexual papillæ distinct. Septal glands IV to VII. Brain almost square, posteriorly deeply emarginated. Dorsal vessel rises in XVI. Intestine covered with thick chloragogen cells. Spermathecæ large, confined to one somite, with a large central chamber representing two primitive, opposite, diverticles; apex of spermatheeal ampulla appears to be connected with the intestine by a pore. No sperm-ducts; the sperm-funnels (fig. 26, *d*) club-shaped, open directly in the penial pore without any intermediary ducts. There is no penial bulb, and no glands of any kind in connection with the efferent apparatus. Testes and ovaries normal. A single ovisac and two sperm-sacs extending backward through several somites. Nephridia with very long duct and many-lobed central part. Lymphocytes small, ovoid, not fringed.

Locality.— Popof Island, Alaska, Prof. Trevor Kincaid.

Characteristics.— Only a few specimens were collected, and of these only one was partially adult. The specimen sectioned did not possess any part of the efferent apparatus and no spermathecæ. The adult specimen was dissected. The form of the spermathecæ and the sperm-funnels opening into the pores without ducts, are so very characteristic that the species cannot very well be confounded with any other species known. The nearest related species is *M. primævus* Eisen, which however possesses a slightly different spermatheca, the difference being in the diverticles and in the length of the organ. The duct leading to the pore in the nephridium is much longer in *M. nanus* than in *M. primævus*.

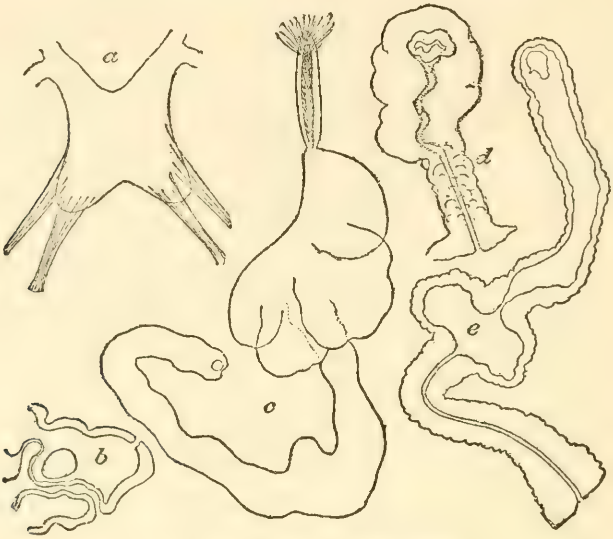


FIG. 26. *Mesenchytræus nanus.*

MESENCHYTRÆUS FONTINALIS sp. nov.

Pl. I, fig. 15; Pl. XI, fig. 3; text-fig. 27.

Definition. — Length 8 mm., width .75 mm. Somites 60. Setæ sigmoid; laterals anterior to clitellum 3, posterior to clitellum 4, 5, 6; ventrals anterior to clitellum 6, posterior to clitellum 7, 6. Head-pore large, situated a little posterior to the apex. Clitellum dorsally $\frac{3}{4}$ XI–XIII, ventrally $\frac{1}{2}$ XI–XIII. Sexual papillæ not prominent. Brain posteriorly truncate or very slightly concave. Septal glands large in IV to VI. Spermatheca cylindrical, with two opposite diverticles on the quarter nearest the intestine. Sperm-ducts about ten times as long as the funnel, furnished with a bottle-shaped enlargement near the pore. No atrial glands. The funnel is very large, three- or four-lobed. Dorsal vessel rises in somite XIX. Sperm-sacs in XII to XVI. Ovisac extends to XVIII. Nephridia with three principal lobes, the general shape deltoid. Lymphocytes very large, oval. Blood orange red.

Locality. — Pine Ridge above the toll-house road near the lumber mills, Sierra Nevada, Fresno County, California. Found among decaying leaves and in the mud in the running water of a small tributary to Rush Creek, the latter being a tributary to Kings River. A truly aquatic species. July and August. Altitude about 7000 feet.

Characteristics.—Readily distinguished by its large lymphocytes, the shape of the lower end of the sperm-ducts and the spermatheca. The diverticles of the latter are situated much nearer the intestine than in *M. pedatus*.

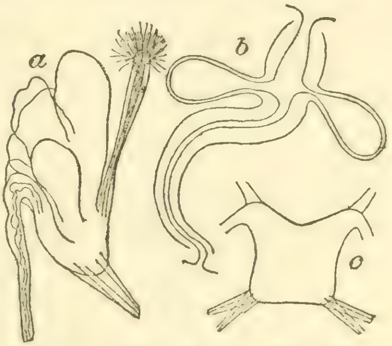


FIG. 27. *Mesenchytræus fontinalis.*

DETAILED DESCRIPTION.

Spermiducal apparatus.—Atrium does not appear to possess any atrial glands. There are numerous large glands which surround the atrium but which open exteriorly to the bulb, around the latter's base. Numerous oblong and very thin penial glands inside the bulb. The bulb is small and possesses fewer muscles than most other species of the genus. On account of the insufficient fixation of the specimens the finer details of the penial bulb could not be made out as well as might be desired. The atrium is large and furnished interiorly with an epithelium consisting of large cubical cells (pl. XI, fig. 3). The funnel is large, occupying more than half of the somite when viewed in a longitudinal section of the body. When dissected it is seen that the funnel consists of three or four clefts, like those of an orange partly split open. The sperm-duct, which runs first upward, then backward, through about four somites in a more or less twisted manner, must be at least ten times as long as the funnel. The exterior papilla is quite low.

Septal glands. — These are large and of the same shape as in *M. pedatus*. Part of the glands adhere closely to the posterior septum while other parts are attached to the lateral ducts leading to the pharynx.

Esophagus and tubular intestine throughout of very even thickness.

Nephridia vary considerably as regards the form of the lobes. Generally three lobes, and the whole nephridium is more or less deltoid.

Lymphocytes. — Unusually large (fig. 15), ovoid or even circular. In all the specimens sectioned, confined to the first thirteen somites. The diameter of an average lymphocyte equals in thickness the epithelium of the body-wall together with half the diameter of the transverse muscular layer. They are strongly granular.

MESENCHYTRÆUS FONTINALIS GRACILIS var. nov.

Text-fig. 28.

Definition. — Length 5 mm., width .5 mm. Somites about 50. Spermatheca with a pair of club-shaped diverticles situated about one-third the distance from the intestine. In other respects similar to the species.

Locality. — In mud of springs near Dinkey Creek, in the Sierra Nevada, Fresno County, California. Altitude about 6000 feet.

Characteristics. — I can find no distinct characteristics other than a greater slenderness of the spermatheca and a greater equality of the two limbs. In the species the ampulla between the intestine and the junction with the diverticles is very short, much shorter than the diverticle. In the variety, the ampulla between the intestine and the junction of the diverticles is about one and one-half times as long as the diverticles, and the part between the pore and the junction of the diverticles is about two and one-half times as long as the diverticles. The diverticles also are longer in the variety than in the species. These differences may be slight, but the fact that they were found to be constant in four specimens of the variety in the six specimens of the species which I dissected shows that they are of considerable importance and worthy of being recorded.

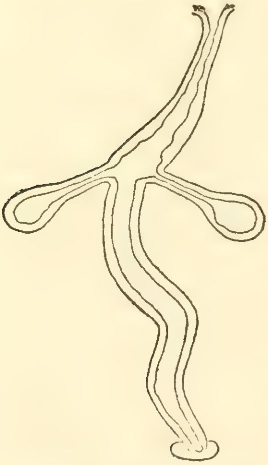


FIG. 28. *Mesenchytræus fontinalis gracilis.*

MESENCHYTRÆUS PEDATUS sp. nov.

(Pl. I, figs. 13 and 14; Pl. IX, figs. 3–6; text-figs. 29 and 30.)

Definition.—Length 10 mm., width .75 mm. Somites 48. Setæ sigmoid; laterals 3–4, ventrals 5–6. Head-pore small, opening halfway between apex of prostomium and peristomium. Clitellum, dorsally $\frac{1}{2}$ XI–XIII, ventrally XII, XIII. A very large exterior copulatory organ, almost as long as the diameter of the body. Brain anteriorly slightly concave, posteriorly with straight margin, a trifle longer than broad. Septal glands in IV, V and VI. Spermathecæ each with two club-shaped diverticles situated halfway up the organ. Sperm-funnels two-thirds as long and broad as a somite. Sperm-ducts at least eight times as long as the sperm-funnel. Sperm-ducts with an atrial chamber before the penial pore. A ring of very large accessory glands open in the immediate vicinity of the sperm-ducts. Dorsal vessel originates in XIV. Nephridia with three somewhat indistinct lobes and a helix-like posterior spur. Lymphocytes of two forms, oblong and round.

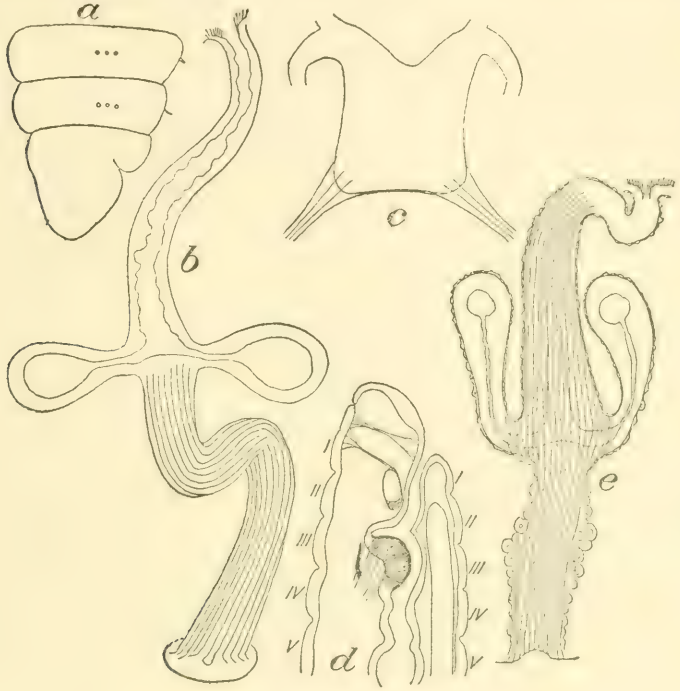


FIG. 29. *Mesenchytræus pedatus.*

Locality.— Found at Goose Lake, Alturas and other localities in Modoc County, California. Collected by Dr. Richard C. McGregor. Probably common in the mud of creeks and lakes in the Sierra Nevada region of northern California.

Characteristics.— Readily distinguished exteriorly by very large copulatory papillæ in XII, especially in specimens where they are fully extended, the papillæ then being as long as the diameter of the body. Interiorly it is prominently characterized by the enormously large accessory glands, which open in the immediate vicinity of the sperm-ducts (PL. IX, fig. 5).

DETAILED DESCRIPTION.

Setæ. — In the first few somites the number of setæ varies between three and four in the lateral fascicles, while in the ventral fascicles we find six setæ in the three anterior fascicles and five in the following. Posterior to clitellum the setæ in the ventral rows are uniformly five, while in the lateral rows they are only four. All the setæ in the same fascicle are of about the same size.

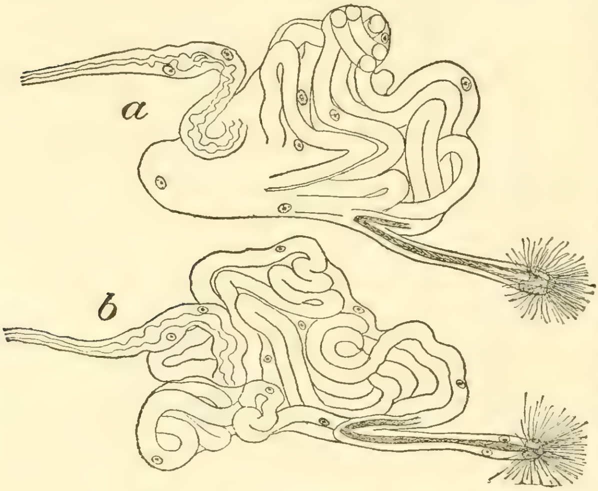


FIG. 30. *Mesenchytræus pedatus.*

Head-pore.— This pore is situated (fig. 29, *a*) a little in front of the shallow groove which separates prostomium from somite I.

Spermiducal apparatus (PL. IX, figs. 4 and 5).—As stated, the large sexual papilla is most conspicuous. When fully extended its long diameter is equal to the diameter of the body at somite XII (PL. IX, fig. 5). The sperm-ducts open at the apex, and this latter is surrounded by the elevated margin of the body-wall, here consisting of large broad cells. Surrounding the opening of the sperm-ducts is a small bulb, into which opens a ring of very large accessory glands. These glands extend inward to the center of the body-cavity. Their structure seems to resemble that of the septal glands. The sperm-ducts are at least eight times as long as the funnels. The duct runs at first back for three somites, turning in XV and then paralleling itself. In XII it is coiled several times, and then, entering in XI, joins the funnel. It is, however, quite narrow, about one-sixth the width of the funnel. In longitudinal section of the body the funnel is seen to be in length two-thirds the transverse diameter of the body and about two-thirds as wide. The sperm-duct possesses an atrial chamber some little distance from the male-pore (pl. IX, fig. 5).

Dorsal vessel rises from the intestine in somite XIV, but does not always separate itself at once. Thus, in one specimen it was fully separated in XIV, in another in XV.

Testes small, solid, in XI; ovaries long, in XII. Two sperm-sacs, tubular in form, extending from XII to XV. Ovisac extends as far back as XVII.

Spermathecæ large, each with two large club-shaped diverticles projecting from the center (fig. 29, *e*). Ampulla of the spermatheca twisted, and sigmoid where it connects with the intestine from the ventral side.

Nephridia (fig. 30, *a* and *b*) consist each of three more or less indistinct lobes. To these must be added a posterior helix-like spur, probably analogous with the spur in the Megadrilid genera (Eisen 16). The tubules wide and closely wound, as in other species of *Mesenchytræus*. It is apparent that the nephridium is built somewhat as in the higher Oligochæta, and there is possibly a 'bridge' starting out from the helix-like spur. The ducts of the spur are much thicker than those in other parts of the nephridium.

Lymphocytes (pl. IX, fig. 3). — Of at least three different shapes and of various sizes — round, oval, or crescent-shaped. The structure appears to be the same in all and I am unable to say whether we have three distinct forms or only variations of one and the same variety.

MESENCHYTRÆUS BERINGENSIS sp. nov.

Pl. X, figs. 1–3; text-fig. 31.

Definition. — Length 15 mm., width .75 mm. Somites about 70. Setæ sigmoid: laterals, 2, 2, 3, 4, 2, 3, 2, 3, 3, 0, 0, 4, 3, 3, 3, 3, 3, 3, etc., 4, 4, 4, 5, 4, 5, 5, 4, etc.; ventrals, 5, 5, 6, 7, 6, 5, 6, 7, 6, 0, 0, 4, 5, 5, etc., 5, 6, 7, 6, 5, etc. Prostomium pointed. Head-pore near apex. Clitellum, XI, XII and XIII. Sexual papillæ large. Septal glands in IV to VI. Brain tapering posteriorly; posterior margin almost straight. Dorsal vessel rises posterior to clitellum.

Intestine with very minute chloragogen cells. Spermathecæ join the intestine in V; diverticles as long as the ampullar part, club-shaped; ampulla inflated and sac-like; duct strongly muscular. Sperm-ducts narrow and probably short. No atrium exterior to the bulb. But inside the latter we find an enlargement of the sperm-duct, of similar form and structure as an ordinary atrium, but without the atrial glands. Below this enlargement there is a swelling of the walls of the duct containing a large number of thin and slender penial glands opening in the very apex of the sperm-duct. Penial bulb with numerous large glands opening around the penial pore. No accessory glands. Sperm-sacs apparently small. Lymphocytes small, ovoid, with pointed ends. Color of alcoholic specimen deep yellow, no pigment.

Locality. — Bering Island, Bering Strait, Alaska. Collected by Dr. Anton Stuxberg, Vega Expedition under Baron Nordenskiöld, August 15, 1879. A single specimen.

Characteristics. — Although the want of specimens prevents a thorough examination and leaves many points undetermined, yet the few characters known are so prominently characteristic that the species cannot be confounded with any other thus far described. The absence of both atrial and accessory glands at the same time is a rare occurrence. In many respects the structure of the efferent apparatus reminds us of *M. pedatus*. The difference between the two species is however great enough. In *M. pedatus* the large glands at the base of the sperm-duct are free and not enclosed in the bulb. In our present species these glands are entirely enclosed in the penial bulb. Neither species possesses atrial glands.

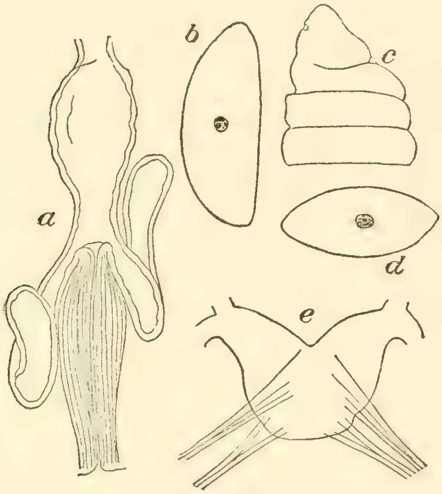


FIG. 31. *Mesenchytræus beringensis.*

DETAILED DESCRIPTION.

Brain (fig. 31, *e*). — Posterior margin almost straight, the general form of the brain rounded, as in fig. 31, *e*. In the specimen examined the two sides of the brain are somewhat unequal.

Setæ. — The setæ diminish slightly in size towards the dorsal and the lateral intervals respectively. No setæ in somites XI and XII.

Spermathecæ (fig. 31, *a*). — The ampulla connects with the intestine in V and is considerably swollen, furnished with thin walls. The duct muscular, exterior surface striped longitudinally.

Sperm-ducts. — As the specimen was sectioned transversely the size of the funnels is not known. The sperm-ducts narrow, apparently not very long, repeatedly folded. The atrium and the penial chamber of nearly equal size, the atrium slightly the larger. The absence of atrial glands a distinct feature. In the penial chamber some few glands opening independently of each other around the pore of the duct, enclosed by the muscular coat of the lower part of the sperm-duct. The penial glands are powerfully developed and crowd the bulb to the utmost. Between the glands are muscles and connective tissue.

The *nephridia* were too macerated to be described satisfactorily.

MESENCHYTRÆUS SOLIFUGUS Emery.

Pl. VII, fig. 8; Pl. VIII, figs. 1 and 2; text-fig. 32.

1898. *Melanenchytræus solifugus* EMERY, '98.
1899. *Mesenchytræus solifugus* MOORE, '99.

Definition. — Length 12 mm., width .5 mm. Somites about 50. Setæ: anteriors about 4, 5, 3; posteriors, 2, 3, etc. Prostomium rounded, blunt and small. Clitellum probably confined to XII. Sexual papillæ prominent. Septal glands small. Spermathecæ straight, with three diverticles in the same plane at the center of the organ. Sperm-ducts comparatively broad, extending at least as far back as XV and probably farther. Funnels cylindrical, folded on themselves, contracted at the center. A large atrium in which opens about eight atrial glands of large size. Many large accessory glands open along the base outside of the penial bulb. About fifteen penial glands inside the penial bulb. Nephridia with three large lobes and a long anteseptal. Lymphocytes small, pointed, ovoid. Color intensely brownish-black owing to pigment which permeates most of the inner organs as well as the body-wall.

Locality. — Occurs on the ice of many of the glaciers of Alaska. Collected by Prof. Trevor Kincaid and Prof. W. E. Ritter on the following glaciers: Muir Glacier, June 11; La Perouse Glacier, June 18. Specimens have also been described by Prof. J. Percy Moore from the Malaspina Glacier.

Note. — Professor Moore partly describes another ice worm, *M. niveus* Moore, from the Malaspina Glacier, said to differ in having posteriorly emarginated brain and in not possessing any diverticles of the spermathecæ. This species is not among those collected by the Harriman Expedition, at least none of those examined by me possessed these characters.

The above definition had already been made out when I received the admirable description of the species by Professor Moore (Proc. Philadelphia Acad. Sci., 1899). This description is so full that few details need be added.

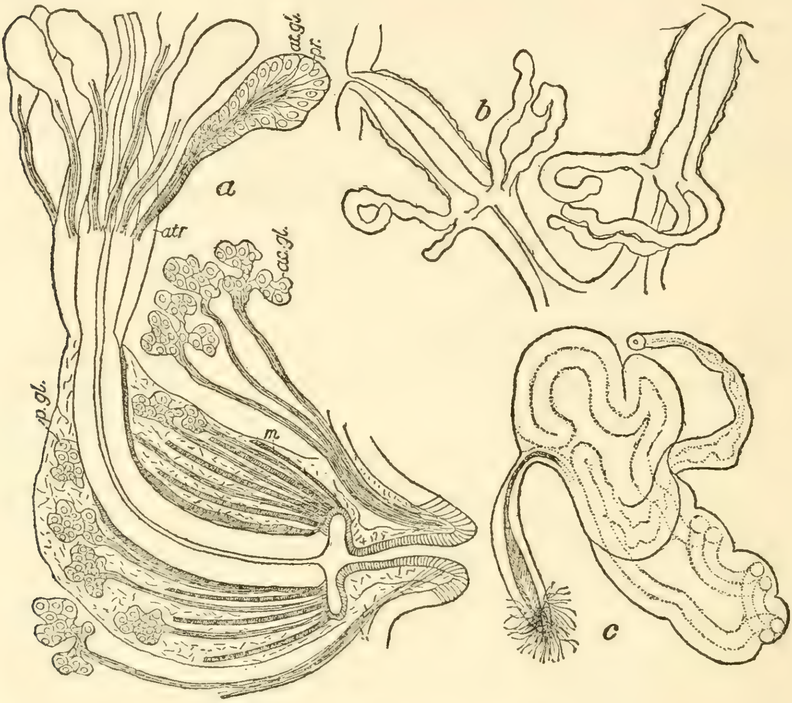


FIG. 32. *Mesenchytræus solifugus.*

Color. — The object of the deep color is probably not alone to absorb heat, but also to exclude light. The worm breeds under the exposure to constant daylight, and the pigment must admirably serve the purpose of modifying this light. All other Enchytræidæ can hide themselves under opaque substances, but this ice worm has no place to hide, as the snow and ice are comparatively transparent. The pigment is distributed not only in the body-wall, but in most of the interior organs, even in the ganglia and the brain.

Spermiducal apparatus.—The accessory glands, which are characteristic, open along the base of the penis outside of the bulb. They are long and of trefoil shape, with enormous long narrow ducts.

It is not impossible that the various glaciers of Alaska contain several species of black ice worms, and it would be of the greatest interest to have these worms carefully collected and fixed so that they could be readily investigated. Most of the specimens in the collection were in a state of decomposition, and it is evident that these worms are extremely sensitive to heat and should be fixed on the spot where collected without first being brought to the laboratory.

Subfamily *ENCHYTRÆINÆ.*

This subfamily contains only two genera, both of which are certainly closely related. In this family the penial glandular structures are not confined within a single bulb as in Lumbricillinæ, but are broken up in two or more masses of papillæ, often of unequal size. In a cross-section of the body these papillæ may be seen to extend from the median line to the other side of the spermiducal pore, and even in the long diameter of the body the glands have a more or less considerable extension. In some species these glands are situated close to each other, in others again they are separated by the common tissue of the body-wall.

Genus **Enchytræus** Henle.

Definition.— Setæ of equal length and straight. Head-pore between prostomium and somite I, always small. No dorsal pores anterior to clitellum. Intestine and esophagus gradually merging into each other. Dorsal vessel rises posterior to clitellum from a vascular sinus of the intestine. One pair of sperm-sacs, surrounded by peritoneal membrane, project from the testes forward. No single penial bulb, but one or more isolated glandular papillæ situated in the vicinity of the spermiducal pores, generally and principally ventral to the pores. Numerous transverse muscles connect the ventral and lateral parietes surrounding the spermiducal pores. Peptonephridia glands present or absent. One kind of lymphocytes. Intestine generally with chylus cells.

As will be seen from the above definition, I have added some characteristics not mentioned by Michaelsen and Beddard. One of these concerns the presence of sperm-sacs. There can be no doubt about the presence of sperm-sacs, just as perfectly developed, though not as large, as those in *Mesenchytræus*. In all the species examined by me such sperm-sacs are present, but vary greatly in size. In *Enchytræus saxicola* they are enormously large, extending as far forward as the spermathecæ. There are, however, no trabecula, at least not in the species which were sectioned. Michaelsen mentions the presence of sperm-sacs in *Enchytræus mœbii* (4), but does not use their presence as a generic characteristic.

Another characteristic relates to the transformation of the penial bulb into separate papillæ surrounding the lower part of the sperm-duct. Such papillæ are found in all other Enchytræid genera which I have investigated, or which I have seen illustrated. In *Enchytræus* the spermducts open independently of any glands. There are however glandular complex in the vicinity of the spermiducal pores in several of the species, and perhaps in all, but they are situated some little distance from the lower part of the sperm-duct, or if close, are still distinctly separated from them. At any rate the sperm-ducts are never directly connected with any glands or ducts of glands, but open independently of any accessory structures through the body-wall.

DETAILED DESCRIPTION.

Brain. — The brain in *Enchytræus* is characterized by the circular mass of fibers in the posterior part of the fiber belt in the brain. As this structure has not been studied in detail its nature is not understood.

Nephridia. — Characterized by the small anteseptal which consists merely of the nephrostome. A similar arrangement is found in *Lumbricillus*. In no instance is there an anteseptal resembling that found in *Fridericia*.

Penial papillæ and structures. — No penial bulb similar to the one found in *Fridericia*, *Lumbricillus*, etc. The sperm-ducts always open separately from the glandular masses, which are found in the vicinity of the ducts. These glands are never surrounded by a special muscular covering, but seem to be more intimately connected with the epidermis, and as such covered by the general muscular layers of the body. In some species we meet with a great number of slightly separated glandular cushions, each consisting of many glandular cells arranged in a pinnate or feathery manner, but all these cells open some little distance from the sperm-ducts. In other species there are only a very few such cell agglomerations. Now and then a muscular strand may be seen to penetrate between the cells down to the body-wall. The muscular penial bulb in other genera is in *Enchytræus* separated by a number of isolated muscular strands, which connect the body-wall in the vicinity of the penial pore with the parietes higher up along the sides of the body.

SYNOPSIS OF SPECIES OF ENCHYTRÆUS DESCRIBED IN THIS PAPER.

I. SPERMATHECA WITHOUT DIVERTICLES.

Spermatheca more or less covered with small glandular cells. No distinct and enlarged pouch..1. *E. modestus* sp. nov.

Spermatheca short and thick, with a large collar of glands at the base. Spermathecal connection with the intestine is situated on the side of the spermatheca. Two large glandular penial papillæ at the penial pore.
2. *E. metlakatlensis* sp. nov.

II. SPERMATHECA WITH A SINGLE DIVERTICLE.

Spermatheca short and thick. The connection with intestine is situated on one side of the spermatheca. Two separate penial papillæ near the spermiducal pore. A few small glands around the base of the spermatheca.
3. *E. kincaidi* sp. nov.

III. SPERMATHECA WITH TWO DIVERTICLES.

Spermathecal diverticles distinct, both of the same size. Stalk of spermatheca longer than the ampulla. A large number of penial papillæ near the spermiducal pore covered by the regular muscular layer of the body.
4. *E. alaskæ* sp. nov.

Spermathecal diverticles of unequal size. Brain deeply emarginated posteriorly. Sperm-funnels very long and narrow. Penial papillæ two, and very minute, situated close to the spermiducal pore....5. *E. saxicola* sp. nov.

Spermathecal diverticles unequal in size. Brain posteriorly convex. Sperm-funnels short and twisted. Two small penial papillæ near the pore.
6. *E. citrinus* sp. nov.

ENCHYTRÆUS MODESTUS sp. nov.

pl. XIX, figs. 2 and 3; text-fig. 33.

Definition.—Length 6 to 7 mm., width .4 mm. Somites 57, pluri-ringed. Prostomium pointed, about one-third shorter than somite I. Intersegmental grooves deep. Setæ straight and of equal length, three in each fascicle, dorsal as well as ventral. Brain posteriorly almost straight, the posterior retractor muscles much narrower than the lateral ones. Dorsal vessel rises posterior to clitellum (undeveloped in the specimens). Spermathecæ without diverticles, straight and more or less warty, not connecting with the intestine. Nephridia with exceedingly narrow inner duct filling only a small part of the nephridium; the anteseptal

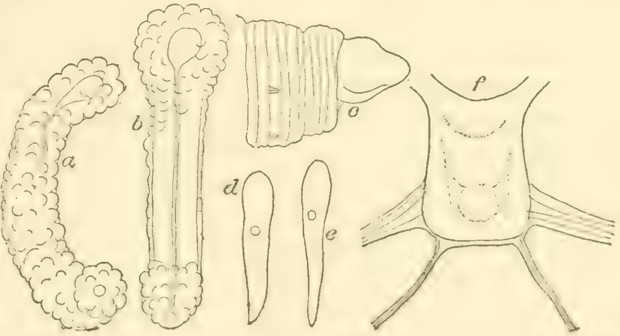


FIG. 33. *Enchytræus modestus.*

consists of little more than the nephrostome. Lymphocytes narrow, long, and rather irregular. Color white.

Locality. — Orca, Prince William Sound, Alaska, June 25, 1899, Prof. Wm. E. Ritter. Only three immature or degenerating specimens, so much twisted and curled that no successful sectioning could be made.

DETAILED DESCRIPTION.

Few additional points can be given. The species seems well characterized by its nephridia, the inner duct in which is narrower than in any other species examined by me.

Sexual papillæ. — The male pores sunk in the specimens; no external penial papillæ. The inner penial papillæ constructed on the same principle as in the other species described in this paper; that is, there is a set of glands grouped in bunches arranged like feathers, between which opens independently the sperm-duct. The particular arrangement could not be made out.

Spermiducal apparatus. — The ducts seem to be short and rather thick.

Intestine is covered by a thick layer of closely set, but transparent and non-staining chloragogen cells.

Lymphocytes. — There is a cyanophil stroma in the meshes, in which there are a few, or comparatively few, eosinophil granules. The nucleus is small but distinct, staining pale blue.

ENCHYTRÆUS METLAKATLENSIS sp. nov.

Pl. xviii, fig. 5; Pl. xix, fig. 1; text-figs. 34–36.

Definition. — Length 12 mm., width .65 mm. Somites 60. Setæ: laterals 3 and 2; ventrals 3 and 4 in each fascicle. Prostomium rounded, blunt. Clitellum XII and XIII. Sexual exterior papillæ small and not prominent. Septal glands in IV, V and VI. Brain oblong, posteriorly slightly emarginated. Dorsal vessel rises in XV. Intestine gradually emerging in the esophagus. Spermathecæ with short and thick duct and with a short apical sac opening into the intestine by a pore; a collar of glands at the base surrounds the exterior pore. Sperm-ducts long and narrow, closely coiled, confined to XII. Sperm-funnels short and thick, bent on themselves. Penial papillæ two, between which open the sperm-ducts. Penial papillæ consist of about 6 lobes in each papilla, the anterior and posterior papillæ being of about equal size. Ovaries in XII, testes in XI. Testes each connected with a sperm-sac which, penetrating the septum, projects into X, filling a large part of the somite. The sperm-sacs are surrounded by a cœlomic membrane. Lymphocytes long and narrow, shuttle-like or elongated ovoid, with the apices sharply pointed. Nephridia with a small anteseptal consisting of nephrostome; the duct is strong, with a lumen much wider than that of the main body of the nephridium; the duct in the main body tightly and apparently irregularly folded.

Color gray.

Locality.— Metlakatla, Alaska, June 4, 1899. Found under sea-weeds, by Prof. W. E. Ritter.

Characteristics.— The contracted spermathecæ are characteristic of this species. Another point of distinction between this species and *Enchytræus alaskæ* is seen in the two penial papillæ, which are of equal size and further apart than in the present species.

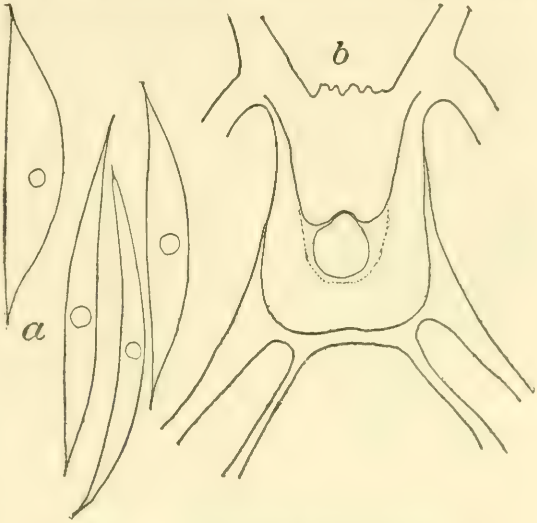


FIG. 34. *Enchytræus metlakatlensis.*

Brain.— The structure of the brain offers some points of interest. The fibers, which in other genera form a solid convex band, are in this, as well as in *E. alaskæ*, broken up into two groups, one forming a globular projection extending further back toward the posterior margin (fig. 34, *b*). It is not improbable that this peculiarity is of generic importance.

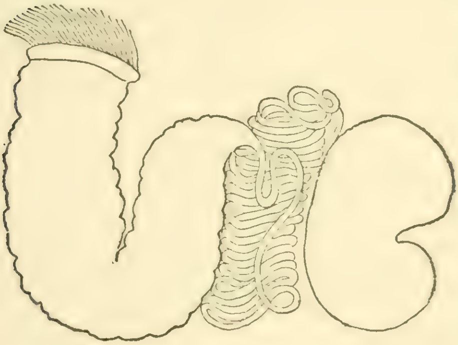


FIG. 35. *Enchytræus metlakatlensis.*

Intestine. — There is a thin coating of broad chloragogen cells in somites VI to IX; in the other somites no such cells can be seen.

Spermathecæ (fig. 36).—The pore connecting with the intestine is not at the apex of the pouch, but situated on one side, as shown in fig. 36.

Penial glands.—In a longitudinal section two separated bunches of glands forming two separate papillæ, one situated in front of the other. Both bunches of equal size, but not strictly in the same plane. As there were no specimens to spare for cross-sectioning, it was not possible to ascertain the whole extent of the glandular structure. The sperm-duct penetrates the body-wall between the two glandular papillæ, but there are no glands entering the ducts.

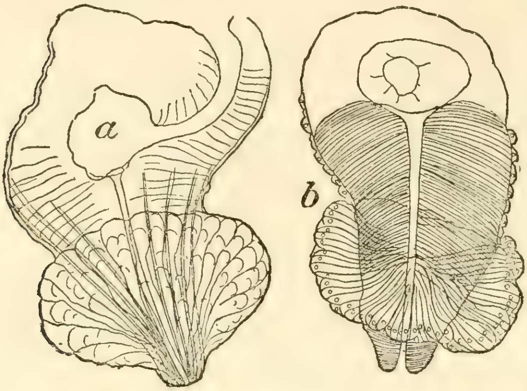


FIG. 36. *Enchytræus metlakatlensis.*

Nephridia.—These organs show great similarity to those of *E. mœbii* Mich., as well as to those of *E alaskæ*. The duct connecting with the nephropore wide, becomes narrow only when it joins the main body of the nephridium. The inner duct is coiled in such a manner that it is impossible to follow its windings for any distance.

Lymphocytes (fig. 34, *a*).—These long and unusually narrow bodies are present in considerable numbers. They attach themselves everywhere by means of their pointed ends.

Sperm-sacs.—There is no doubt about the presence of a cœlomic membrane surrounding the developing spermatozoa, thus constituting a regular sperm-sac. Where the sac penetrates the septum X/XI a few trabeculæ are seen to extend forward through the mass of developing spermatogonia.

ENCHYTRÆUS KINCAIDI sp. nov.

Pl. XVIII, figs. 2–4; text-figs. 37 and 38.

Definition.—Length 20 to 25 mm., width .75 mm. Somites about 67. Setæ: anterior ones slightly more slender than the posterior ones; laterals, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, etc.; ventrals, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 0, 2, 2, 2, etc. Other specimen: laterals, 3, 3, 3, 4, 4, 4, 4, 3, 3, 3, 2, 2, 2, 2, 2, etc.; ventrals, 3, 3, 4, 4, 4, 3, 3, 3, 3, 0, 0, 3, 2, 2, 2, etc. Body-wall transparent. Prostomium blunt, rounded, intersegmental grooves shallow. Clitellum with thin walls XII and XIII. Sexual papillæ not present. Septal glands in IV, V and VI; those in IV the smallest, and those in VI the largest. Peptonephridia consist of one or two short and broad twisted lobes. Brain longer than broad, posteriorly distinctly convex. Dorsal vessel rises in XVI. Intestine without chloragogen cells. Spermathecæ short and thick, with one diverticle at the inner apex; the main body connects at its center with the intestine. Spermducts narrow, coiled, confined to XII. Funnels large, three times as long as broad. Penial inner papillæ two, the posterior one the largest; the cells with a feathery and radiating arrangement. Sperm-sacs: one pair connected with the testes, projecting forward into somite X; no trabecula present. No ovisacs. Nephridia with anteseptal consisting only of nephrostome; duct thin and much coiled. Lymphocytes broad, irregularly ovoid, not large, cyanophil, without eosinophil granules. Color white, body entirely transparent.

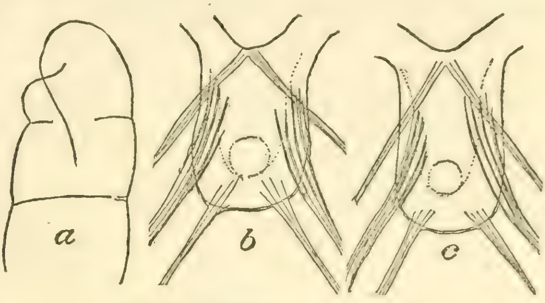


FIG. 37. *Enchytræus kincaidi.*

Locality.—Popof Island, Alaska, Prof. Trevor Kincaid. Under rocks on the shore. Several specimens in very fine condition.

Characteristics.—As usual the form of the spermathecæ is the most characteristic feature.

DETAILED DESCRIPTION.

Setæ.—The setæ straight with the basal part considerably curved. All in the same fascicle of the same or nearly the same length; no one decidedly longer than the rest.

Clitellum.—The wall of the clitellum not more than twice as thick as the general body-wall. Even the body-wall unusually thin.

Brain (fig. 37, *b*).—Brain as in the other species of this genus described in this paper. A circular mass of fibers at the apex of the inner fiber curve.

Spermathecæ.—Several specimens dissected; spermathecæ found to vary but little in form. The lower end furnished with a set of glands near the pore, the glands opening into the duct. The connection with the intestine at the center of the whole organ. A short and thick diverticle points upward and forms the inner apex of the organ.

Sexual glands.—The penial papillæ on each side consist of two distinct and separate masses of glandular cells arranged in the usual feathery manner characteristic of this genus. There are two agglomerations of such glands, one anterior to the other, the anterior one being the smallest. In the specimen sectioned longitudinally the former gland-complex is seen to consist of eight agglomerations, while the latter or anterior one contains only three or four. There is, however, some variation, as in one dissected specimen the anterior complex is only one-third smaller than the posterior one. The sperm-funnels are somewhat curved and about three times as long as wide. *Sperm-ducts* open independently of the penial papillæ and a little more ventrally than either.

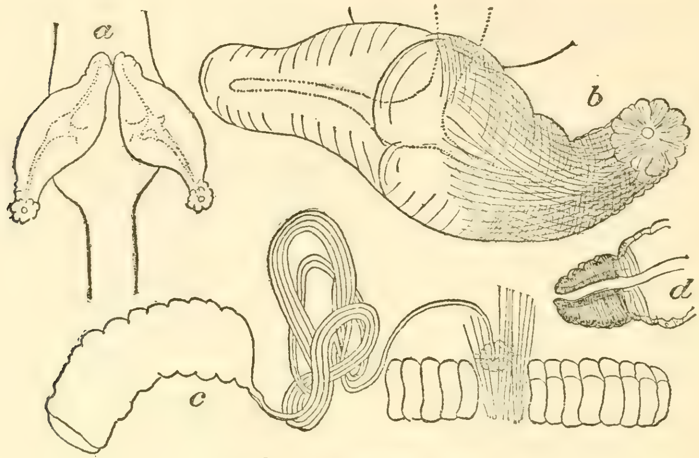


FIG. 38. *Enchytræus kincaidi.*

Nephridia.—The inner duct narrow, running in a zigzag manner. Sections show that the lumen is connected with innumerable minute and probably branching ducts, too small to be indicated on the figure (Pl. XVIII, fig. 3).

ENCHYTRÆUS ALASKÆ sp. nov.

Pl. I, fig. 19; Pl. XIX, figs. 4–6; Pl. XX, figs. 1–2; text-figs. 39 and 40.

Definition.—Length 15 mm. or less, width .75 mm. Somites 65, strongly tapering toward the tail end. Prostomium rounded; somite I smaller than II or III. Head-pore between prostomium and somite I. Setæ straight: anterior laterals 3, posterior 2; anterior ventrals 3, posterior 2 and 3. Sexual papillæ not prominent. Clitellum distinct, XI to XIII, saddle-shaped. Septal glands in IV, V and VI. Peptonephridia short and undivided. Brain posteriorly slightly concave, oblong. Dorsal vessel rises in XV, but separates only in XII. Esophagus gradually emerging in the sacculated intestine. Spermathecæ with long stalk and a lopsided ampulla connecting with the intestine. Sperm-funnels short, bent. Sperm-ducts narrow, coiled, in XII and XI, opening on the side of small penial papillæ. A pair of large interior penial papillæ near the male pores. Nephridia large, rounded, with granular neck and greatly coiled duct. Anteseptal consists merely of the nephrostome. Lymphocytes of two forms, rounded-oval and tapering. Both are erythrophil. Color white.

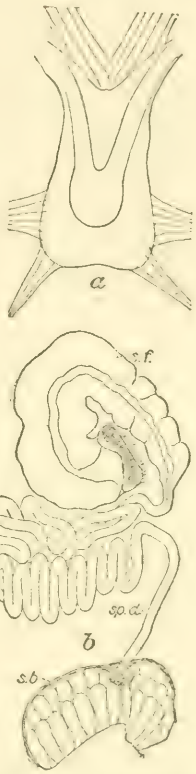


FIG. 39. *Enchytræus alaskæ.*

Locality.—Garforth Island, Muir Inlet, Glacier Bay, Alaska, June 9, 1899, Prof. W. E. Ritter.

DETAILED DESCRIPTION.

Penial interior papillæ.—The most interesting features of the species of this genus are the structure of these organs. The penial interior papilla is in itself very small, and consists of two unequal papillæ, between which the sperm-ducts open. The smaller is situated close to the body-wall (pl. XIX, fig. 4), while the larger is situated nearer the ventral ganglion. The sperm-ducts open between these two papillæ. There are numerous muscles between the two papillæ as well as between the sperm-duct and the papillæ. The papillæ contain only one kind of glands, which do not open into any lumen, but onto the exterior surface of the body. No glands open into the sperm-duct. Besides these comparatively small penial papillæ we find located more centrally two larger penial papillæ close to the ventral ganglion (pl. XIX, fig. 6). In a transverse section of the body of the worm these penial papillæ are not cut at the same time as the other penial papillæ, the latter being situated a little anterior to the former. The penial papillæ are all of the same general structure and contain a number of unicellular glands arranged in many isolated bunches, each bunch opening separately from the other. Between these papillæ are seen a number of smaller glandular papillæ in a continuous row across the somite. Somewhat similar structures have been figured by Michaelsen for *E. mœbii*, and I contend that they are characteristic of this genus.

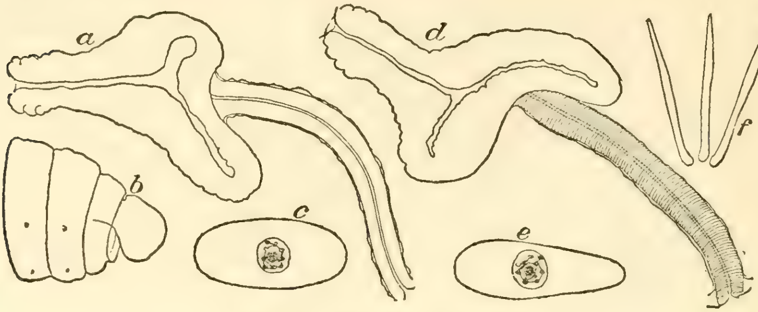


FIG. 40. *Enchytræus alaskæ.*

ENCHYTRÆUS SAXICOLA sp. nov.

Pl. XVIII, fig. 6; text-fig. 41.

Definition.—Length 15 to 20 mm., width .65 mm. Somites 63. Body transparent, with thin walls. Prostomium blunt and rounded. Head-pore between prostomium and somite I. Setæ straight: laterals, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 2 (15 somites), 3, 3, 3, 3, etc.; ventrals, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 0, 2 (12 somites), 3, 3, 3, etc. Clitellum XII and XIII, prominent. No external sexual papillæ. Brain posteriorly deeply emarginated, longer than broad. Dorsal vessel rises posteriorly. Intestine much narrower in somites VII to X. Spermathecæ short and thick, each with a single diverticle; connects centrally

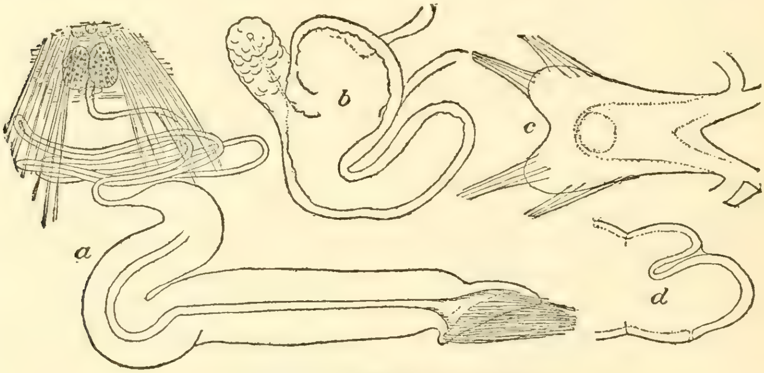


FIG. 41. *Enchytræus saxicola.*

with the intestine in V; duct short and narrow. Sperm-ducts narrow, a few times longer than the funnel, which is long and narrow, with the basal part sigmoid. A minute penial papilla situated ventrally and close to the spermiducal pore. The sperm-ducts open independently of these glands. One pair of long cylindrical sperm-sacs extend from the testes forward through somites X to VII. No ovisacs. Nephridial anteseptal consists of only the nephrostome. Lymphocytes of medium size, thicker at one end, strongly granular. Color transparent white.

Locality.— Lowe Inlet, British Columbia, June 3, 1899, Prof. Trevor Kincaid. "Under rocks at high tide."

Characteristics.— This species undoubtedly stands near *E. kincaidi*, but differs not only in the form of the spermathecæ, but also in the emarginated brain, and in the presence of only one small penial papilla near the pore of the sperm-duct.

DETAILED DESCRIPTION.

Brain.— The longitudinal diameter is about twice as long as the transverse one. There is a central circular and somewhat globular mass of fibers in the fibrous band.

Spermathecæ.— The diverticle is wide, in one spermatheca entire, in the other indistinctly lobed, forming chambers containing balls of spermatozoa. The duct resembles that of *E. kincaidi;* the diverticle wider than in that species. The connection with the intestine at the center and at one side of the organ.

Sperm-funnels.— One of the funnels somewhat shorter than the other. The longest funnel is represented by the figure (41, *a*).

Spermiducal pores.— As in other species of this genus described in this paper, no trace of any penial bulb. The sperm-ducts open independently of any glands. A small penial papilla close to the pore, situated more ventrally. It contains two minor gland agglomerations situated side by side, and two or three smaller ones situated nearer the ganglion. As a substitute for a penial bulb there are numerous muscle fibers connecting the ventral and dorsal parietes around the spermiducal pore, just as in the higher Oligochæta, as for instance in *Pontodrilus.*

Sperm-sacs.— They consist of two very large bodies surrounded by a peritoneal membrane of great toughness. They fill entirely somites VIII to X, and encroach upon VII. The intestine is quite narrow in the somites occupied by the sperm-sacs. The sperm-sacs are slightly contracted by the septa. Compared with the sperm-sacs of *E. kincaidi*, those of the present species are two or three times as long, but not quite so wide. They are readily dissected out without breaking.

ENCHYTRÆUS CITRINUS sp. nov.

Text-fig. 42.

Definition.— Length 17 mm., width .5 mm. Somites 50. Prostomium blunt. Setæ: laterals, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2 (for 11 somites), 3, 3, etc.; ventrals, the same as the laterals, except 0 in XII. Clitellum XII–XIII. No sexual papillæ exteriorly. Brain slightly longer than broad, posteriorly convex. Dorsal vessel rises posteriorly (probably in XVI). Blood deep lemon-yellow. Intestine narrower in somites VIII to X. Spermathecæ with large and thick apical ampulla and a distinct and strong duct. Sperm-ducts about three times as long as the funnel. The funnels rather short, sigmoid. Two very minute internal penial papillæ close to and a little ventral to the spermiducal pore. Lymphocytes of medium size, ovoid, tapering toward one end. Nephridia similar to those of *E. saxicola*. Color deep lemon-yellow.

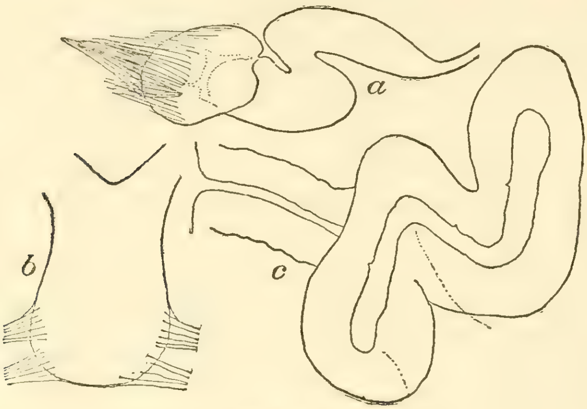


FIG. 42. *Enchytræus citrinus.*

Locality.— Lowe Inlet, British Columbia, Prof. Trevor Kincaid, June 3, 1899.

Characteristics.— There is considerable doubt whether this form should be arranged as a distinct species or considered a variety under *E. saxicola*. While it is true that the spermathecæ are somewhat larger and slightly different in shape, the main distinction between the two species lies in the shape of the brain and in the color of the blood. The specimens of both *E. saxicola* and *E. citrinus* were transmitted to me in the same bottle and had been collected at the same place and preserved in formalin in the same manner. Still in *E. citrinus* the blood was deep yellow, while in *E. saxicola* it was white or uncolored. The brain in the two species is distinct in shape.

Spermiducal apparatus.— Funnels smaller than in *E. saxicola*, the two small inner papillæ close to the spermiducal pore more minute than in that species. Two large sperm-sacs extending through several somites anterior to XI. In shape these sacs resemble those of *E. saxicola.*

Genus **Michaelsena** Ude (part).

Definition. — Setæ straight, more or less absent in majority of the somites. Head-pore between prostomium and somite I. No dorsal pores. Esophagus gradually merging into the intestine. Dorsal vessel rises posterior to clitellum, and is without cardiac gland. No peptonephridia. Testes solid. Nephridia as in *Enchytræus.* Penial papillæ without interior muscular strands. No penial bulbs.

To the definition given originally by Ude I have added the characteristics of the penial bulb, and modified that referring to the setæ. It is to my mind evident that if we are to recognize the genus *Michaelsena* we must make the definition wide enough to include both Michaelsen's species, *Enchytræus monochætus*, and my new species, *Michaelsena paucispina.* These species differ but slightly from *M. subtilis* Ude, the differences referring only to the number of missing setæ. In *M. paucispina* the setæ are entirely absent on the anterior three somites, and in all the other anterior somites only two ventral setæ are found in each somite. In some of the posterior somites there are four setæ in each somite. In *Enchytræus monochætus* a further reduction has taken place, as there are no setæ in the anterior five somites. Then follow other somites with only ventral setæ, while the majority of somites seem to possess four rows of single setæ. In *M. subtilis* another step in the reduction has been taken, and we find in this species only ventral setæ in somite IV, V and VI. In all the other somites the setæ are absent. I cannot see how we could very well include one of the above species in the genus and exclude the others. So far as known there are no characteristics of sufficient importance to separate these three species in different genera.

SYNOPSIS OF SPECIES.

1. *Michaelsena subtilis* Ude. Setæ found only in somites IV, V and VI, and here only two pairs corresponding to the ventral fascicles. Size 5 to 6 mm.
2. *M. monochæta* (Michaelsen). The anterior four or five somites without any setæ. The following few somites possess only single ventral setæ, while all the other somites possess four single seta, each setæ corresponding to single fascicle. Length 7 mm., width .25 mm.
3. *M. paucispina* sp. nov. Somites I, II and III without setæ. All other anterior somites with two ventral setæ, each seta corresponding to a fascicle. The posterior somites with four setæ each, each seta corresponding to a fascicle. Length 7 mm., width .2 mm.

It may be noted that all the three species seem to be marine forms, occurring along the seashore among seaweeds.

MICHAELSENA PAUCISPINA sp. nov.

Text-fig. 43.

Definition.—Length 7 mm., width .2 mm. Somites 45. Setæ absent in somites I to III; in somites IV to XIII no lateral setæ present, but each of these somites, except VIII and XII, possesses two ventrally located setæ, each corresponding to the ventral fascicles. Commencing with somite XIV, all the posterior somites contain 4 setæ each, each seta corresponding to a ventral or lateral fascicle. In the last quarter of the body the setæ gradually increase in size in such a manner that the setæ in the last ten somites are twice as thick and a trifle longer than the anterior setæ. Setæ are straight, pointed with a swelling at the center. Prostomium large, rounded. Head-pore small, between prostomium and I. Septal glands in IV to VII. Dorsal vessel seems to rise in XV. Clitellum distinct, in XII and XIII. No sexual papillæ. Color pale yellow.

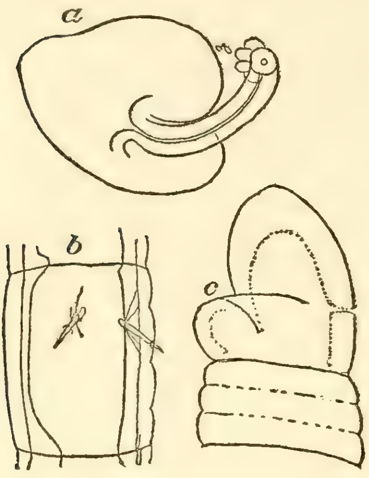


FIG. 43. *Michaelsena paucispina.*

Locality.—Santa Barbara, California (seashore), Prof. H. P. Johnson of the University of California. A single specimen, preserved on a microscopical slide.

Characteristics.—The nature of the single specimen did not allow any dissection, and it was thought best not to attempt sectioning. This explains the want of knowledge of any of the interior structures. The species differs from *M. monochæta* Michaelsen by its lighter color and by the absence of lateral setæ in the somites anterior to clitellum. The two species are, however, most closely related.

Spermathecæ.—Judging alone from optical view of the body, the spermatheca appears to possess a long narrow duct, at the base of which are a few glands. The ampulla seems to be very large and deltoid, projecting downward somewhat in the manner represented in the figure. No other details can be added.

Subfamily *LUMBRICILLINÆ*.

With the exception of *Sterceutus* and *Bucholzia* the structure of the penial bulb is rather uniform and varies but little in the various genera.

In the two genera mentioned the structure is not known, and these genera are only placed in this subfamily on account of their similarity in other respects to the better known genera. The variability of the structure of the setæ is best known in *Bryodrilus* and *Henlea*, where some species possess straight setæ while in others they are curved. The genus *Henlea* is particularly variable, containing species in which the setæ resemble all the three forms — Lumbricillide, Enchytræide and *Fridericia*.

Genus **Lumbricillus** Oerst.

Definition. — Setæ sigmoid, arranged in fan-shaped fascicles. Head-pore small, situated between prostomium and peristomium. Brain generally deeply emarginated posteriorly. Ventral sexual glands around the ventral ganglion generally present. Blood red or yellow. Dorsal vessel rises posterior to clitellum. No cardiac gland. No peptonephridia. Testes multi-lobed, each lobe capped by a small sperm-sac. Sperm-ducts comparatively narrow. Penial bulb without inner muscular strands, containing only numerous glands of various kinds, some of which may open into the basal part of the sperm-duct. No atrium and no glands outside of the penial bulb. Nephridia with entire postseptal and with an anteseptal which consists merely of the nephrostome.

To the definition of this genus by Michaelsen I have added the points concerning the testes and the nephridia. The fact that the testes are capped by small sperm-sacs has, I believe, not been previously noted. The small anteseptal, consisting of only a nephrostome, is probably characteristic of this genus, though it is also found in some other genera.

DETAILED DESCRIPTION.

Nephridia. — The nephridia in *Lumbricillus* are quite distinct as regards the anteseptal part. In all the species which I have investigated, as well as in all which I have seen figured, the anteseptal part consists of merely the nephrostome. The postseptal is divided into two parts, the lobe and the duct. The lobe is generally, if not always, broad and disc-like and the duct is short. The postseptal lobe is frequently furnished with granules or with bladder-like elevations near the anteseptal. In the majority of species of Marionina the anteseptal is large, resembling the *Fridericia* and *Henlea* type, while the *Lumbricillus* type is also seen in *Enchytræus*. Even the postseptal part of the Lumbricillide nephridium is characterized by its flatness and by its more or less circular outline.

Penial bulb.—The penial bulb in *Lumbricillus* differs in structure from that of *Mesenchytræus* and *Enchytræus*, but resembles that found in the other genera so far as known. The bulb consists of an exterior capsule of muscle strands. Inside the capsule we find one or more kinds of glands, which radiate from the base of the bulb towards the periphery. These glands are all single cells, each one of which is separate from those nearest, each one opening separately around the penial pore. Some species possess glands which open in the lower part of the sperm-duct, inside the bulb and close to the pore (Pl. XIII, fig. 1). It is probable that this latter structure may be found in all the species, and that it is characteristic of the genus.

Sperm-sacs and testes. — As has been already stated in a previous paper (Eisen 1900), each separate lobe of the testes is capped by a small sperm-sac. This arrangement is also found in *Ocnerodrilus occidentalis*, but not in the other species of *Ocnerodrilus*, which led me to separate *O. occidentalis* as a special subgenus. The testes in the various species differ from each other to some extent, but not sufficiently to furnish species characteristics of any practical use. The spermatogonia of the testes separate and fall into the small sperm-sacs and there undergo their further development into spermatozoa. Spermatophores are not known in this genus.

SYNOPSIS OF SPECIES OF LUMBRICILLUS DESCRIBED IN THIS PAPER.

I. SPERMATHECA WITH A SINGLE ROSETTE OF GLANDULAR CELLS AT BASE. These cells do not extend upward on the stalk or on the main part of the spermatheca, but enter the lower part of the spermatheca about ten to fifteen cells high.

The lower half of the spermatheca enlarged and pouch-shaped. Ventral glands in XIV and XV, ventral and slightly lateral........ 1. *L. santæclaræ* sp. nov.

II. SPERMATHECA COVERED WITH GLANDS ALONG THE ENTIRE LENGTH OF THE DUCT, BESIDES POSSESSING A ROSETTE OF GLANDS AT THE BASE.

Brain distinctly emarginate posteriorly. Spermatheca with a distinct narrow duct uniting the ampulla with the pore. Glands covering the duct increasing in length toward the base. Ventral glands in XIV, XV, XVI, and XVII, the glands of equal size.................................... 2. *L. merriami* sp. nov.

Brain truncate posteriorly. Spermathecal duct long, but the ampulla very small and hardly differentiated exteriorly. Ventral glands of large size in XIV, XV, XVI, XVII, XVIII and XIX.................. 3. *L. annulatus* sp. nov.

Brain emarginated posteriorly. Spermathecal ampulla large, with a distinct duct leading to the pore. Glands covering the duct of even size, not broader toward the base. Ventral glands in XIII, XIV, XV, XVI, and XVII. Nephridia with glandular zone near the nephrostome...4. *L. ritteri* sp. nov.

III. SPERMATHECA WITHOUT DISTINCT GLANDULAR COLLAR AT BASE, but with a continuous covering of glands from top of duct to base, the glands gradually increasing in size toward the base.

Spermathecal ampulla globular. Ventral glands in XIV, XV, and XVI, increasing in size posteriorly; ventral, lateral, and dorsal.
5. *L. franciscanus* sp. nov.

LUMBRICILLUS SANTÆCLARÆ sp. nov.

Pl. XIII, figs. 3 and 4; text-figs. 44–46.

Definition. — Length 8 to 12 mm., width .5 mm. Somites about 50. Setæ slightly sigmoid, averaging one more in the ventral than in the lateral fascicles. Ventrals 6, 8, 7, 6, 5, 4, 3; laterals 6, 7, 6, 6, 4, 3, 3. Head-pore large, between prostomium and somite I. Head blunt and rounded. Clitellum not prominent, XII and XIII. Copulative papillæ small. Septal glands thick and compact, septal part about equal to interseptal part. Brain about 30 units long and 12 units broad (at center), and strongly emarginated posteriorly. Dorsal vessel rises in XIV. Intestine gradually widening. Spermathecæ with a thick duct distinct from the ampulla. A thin ring of glands at the base of the duct. Sperm-ducts thin, confined to somite XII. Sperm-funnels slightly more than three times as long as wide, curved. Penial bulb round, small. Testes multi-lobed. Ovisac not extending posterior to clitellum. Ventral glands in XIV and XV. Nephridia thick, with a minute anteseptal and a thick postseptal from the posterior end of which the thick duct projects.

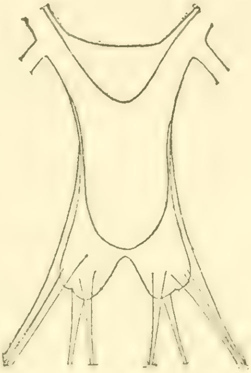


FIG. 44. *Lumbricillus santæclaræ.*

Locality. — Banks of Santa Clara Creek, San Mateo County, California.

Characteristics. — The prominent feature in this species is the shape of the spermatheca and the very thin disc of glands at its base.

DETAILED DESCRIPTION.

Three specimens were dissected and three sectioned, one of them transversely. As none of the specimens had been properly fixed, no attempt is made to describe the finer structure.

Length. — The specimens at my disposal varied somewhat as regards length, some being not over 8 mm., while others were 12 mm. The somites varied between 45 and 55, the most mature specimens being the largest.

Setæ vary to the extent that in some specimens the anterior ventral bundles possess one more seta than in other specimens. Thus I have once counted as high as nine setæ in one or two of the bundles. The setæ are of rather uniform size in each bundle.

Prostomium and front of the head are blunt or rounded and much bent downward. The mouth is well down on the ventral side. The body-wall is thin and transparent in glycerin specimens, and the inner organs can be fairly well seen. There is but a slight depression between the somites, and the body is smooth and glossy.

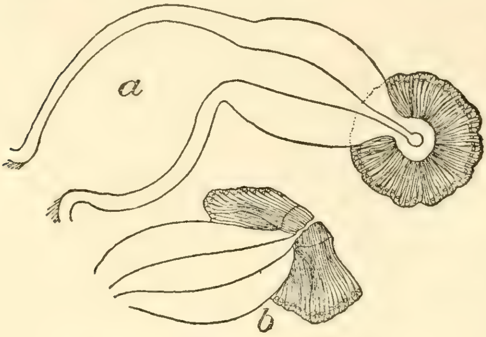


FIG. 45. *Lumbricillus santæclaræ.*

Septal glands.—There are septal glands in IV, V and VI. The septal part attached to the posterior septum is thick and not lobed, with even outline, and, seen in a longitudinal section of the body, this septal part is as wide and of the same general shape as the interseptal lobe which lies free in the middle of the somite. There are no salivary glands.

The brain (fig. 44) is remarkable for its length. In the most elongated the length is about thirty units, while the width at the center is only twelve units. The posterior margin is deeply emarginated and the two lobes show some slight secondary lobing (fig. 44). There are two lateral muscles, and each central lobe is attached by two muscular strands.

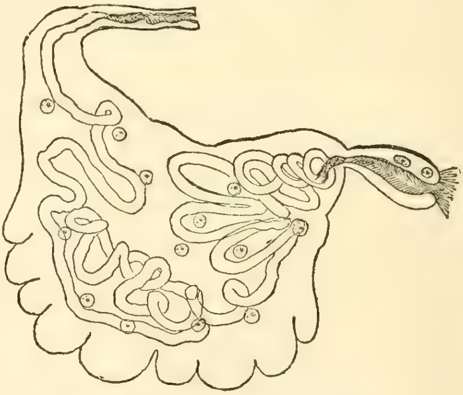


FIG. 46. *Lumbricillus santæclaræ.*

Spermathecæ.—A contraction at the middle divides the ampulla proper from the more muscular duct. Both parts of about equal size and bent toward each other in a knee-like manner. The glands at the base in the shape of a thin even disc, saucer-shaped, with the concavity toward the intestine. The connection with the intestine wide and reflexed. The form of the spermathecæ varies but slightly in the specimens dissected.

Sperm-ducts thin and very much coiled, confined to the anterior part of somite XII. The funnels slender and the ciliated mouth turned dorsally. In the upper part of the penial bulb the sperm-duct is thick and muscular, but at the center or below the center the duct becomes thin and loses its muscularity. The glandular cells ot the bulb are of two kinds. One kind is confined to a thin lining of the sperm-duct proper (pl. XIII, fig. 3). The other kind consists of the regular penial glands which open on the surface of the penial papilla.

Testes.—The lobes of the testes are oblong pear-shaped, and 8 to 10 in number. In the sectioned specimens the testes were in degeneration and only one or two lobes were seen.

Intestine is covered with a thin layer of chloragogen glands.

Ventral glands (pl. XIII, fig. 4).—There are two cellular accumulations on the ventral ganglion, one in XIV and the other in XV. They are both of the same size. Seen in cross-section they are found to be many times wider than the ganglion, but do not rise much above its general level.

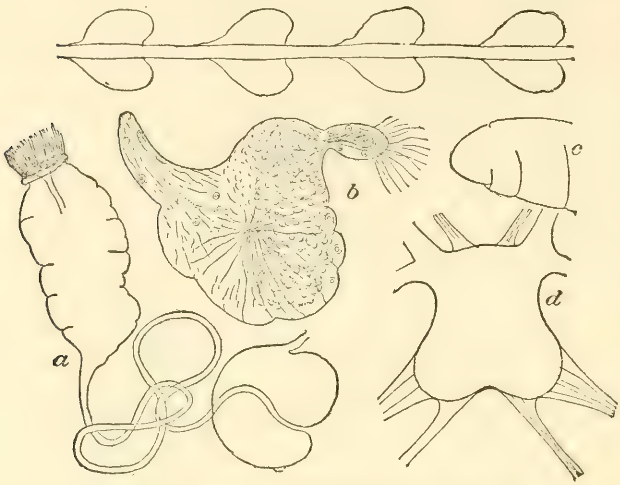
Nephridia.—There are at least three rows of nuclei. The inner duct is more densely wound at the neck near the anteseptal than in the posterior part of the lobe. The figure (fig. 46) gives a general idea of the windings; the boundaries of the cells could, however, not be made out.

Lymphocytes.—None of the specimens contained any lymphatic cells in the anterior part of the body, the only part which was sectioned. Nor could I find any in the dissected specimens.

LUMBRICILLUS MERRIAMI sp. nov.

pl. XII, fig. 5; text-figs. 47 and 48.

Definition.—Length about 12 mm., width .6 mm. Somites 55 to 62. Body transparent, the anterior somites dorsally hardly distinguishable. Prostomium blunt and rounded. Setæ: laterals, 5, 4, 4, 4, 4, 4, 3, 3, 3, 3, 3, 4, 3, 2, 2, 2, 2; ventrals, 4, 5, 5, 5, 5, 5, 5, 6, 6, 4, 0, 4, 3, 3, 3, 3, 3, 3. Head-pore between prostomium and I. Sexual papillæ small, but distinct. Clitellum XI½ XIV, not prominent. Septal glands in IV to VII. Brain almost square or a little longer than broad, posteriorly deeply emarginated, anteriorly slightly convex. Spermathecæ with large basal gland rosette and with the stalk pyramidally covered with glands. Apical ampulla small and conical, about one-third of the whole spermatheca. Sperm-ducts only about twice as long as the funnel, narrow. Funnel about three times as long as wide, with small recurved collar. Penial bulb comparatively large, about one-half to one-third shorter than the funnel. Testes large, filling the whole somite, and consisting of from 12 to 15 lobes, each lobe consisting of about three secondary lobes, each of which terminates in a sperm-cap. Ovaries pluri-lobed, smaller than the testes. Ventral glands all of the same size, about six times as wide as the ventral ganglion, situated in XIV to XVII. Nephridia with small anteseptal consisting alone of the nephrostome. The anterior part of the postseptal is covered by wart-like elevations, under which the duct is much twisted; no warty elevations in the posterior part of the postseptal; stalk short and thick; duct narrow and difficult to follow. Lymphocytes variable, ovoid, more or less pointed. Color of formalin specimens decidedly gray. The body is smooth and rather glossy.



FIGS. 47 AND 48. *Lumbricillus merriami.*

Locality.—Metlakatla, Alaska, June 4, 1899, Prof. W. E. Ritter. Under decaying seaweeds. A single specimen from Popof Island, collected by Prof. Trevor Kincaid. The species is named for Dr. C. Hart Merriam.

Characteristics.—The specimens which apparently had been placed directly in the formalin solution had not contracted sufficiently to show any deep intersegmental grooves. This characteristic made it easy to pick out the species from others collected at the same time and in the same locality. The intersegmental grooves between the first few anterior somites are dorsally so shallow that it is with difficulty that the somites can be distinguished one from the other.

Setæ.—In the majority of fascicles the setæ diminish toward one side, but while in some the diminution is toward the ventral interval, in others it is toward the lateral interval, following apparently no constant rule.

Spermathecæ (pl. XII, fig. 5). — The apical ampulla small and tapers toward the intestine; the entrance to the intestine not at the apex, but nearer the base of the ampulla.

LUMBRICILLUS MERRIAMI ELONGATUS var. nov.

Pl. XII, fig. 6; test-fig. 49.

Definition. — Brain less emarginated posteriorly, slightly longer and narrower than the species. The ampulla of the spermatheca is about equal to the glandular duct. There is about one more seta in the majority of the fascicles than in the species. Testes with about ten lobes. Sperm-funnel shorter and more globular than in the species.

Locality. — Metlakatla, June 4, 1899. Found under seaweed together with the species.

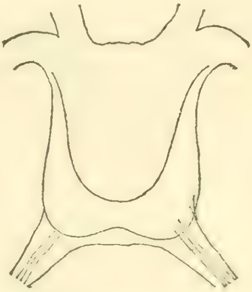


FIG. 49. *Lumbricillus merriami elongatus.*

LUMBRICILLUS ANNULATUS sp. nov.

Pl. XVIII, fig. 1; text-figs. 50–52.

Definition.—Length about 12 mm., width about .75 mm. at clitellum, from which point the body strongly tapers toward each extremity. Somites about 56. Setæ: laterals, 5, 5, 6, 6, 6, 5, 5, 5, 6, 4, 3, 3, 4, 4, 4, 3, etc.; ventrals, 6, 6, 8, 8, 8, 7, 9, 8, 7, 7, 0, 6, 6, 6, 5, 5, 5, etc. Prostomium slightly poted. Except for the first few somites the intersegmental grooves are very deep. Clitellum ½ XI ½ XIV. Sexual papillæ not large, but still quite prominent. Septal glands in IV to VII. Brain with a slight emargination posteriorly; the lateral retractor muscles are unusually broad at their attachment to the brain. Dorsal vessel rises in from XVI to XIV. Intestine covered with a thin layer of chloragogen cells; in XII this layer consists of very few and very small cells. Spermathecæ with basal collar of glands and with a thick layer of glandular cells extending to the apex of the ampulla; the latter is hardly differentiated. Sperm-ducts short and narrow. Sperm-funnels about twice as long as broad, and about one-third longer than the penial bulb. The penial bulb contains three different kinds of long, narrow cells. Ovaries in XII much lobed. Testes in XI penetrate the septum into X, partly filling that somite. Ventral glands of large size in XIV to XIX, small ones not projecting beyond the ganglion and only perceptible in sections, in III to X. Nephridia with anteseptal consisting only of the nephrostome; rounded, thick and rugose postseptal body and short postseptal duct. Lymphocytes variable, irregularly ovoid, with filamentous ends. Color deep gray.

Locality. — Metlakatla, Alaska, June 4, 1899 (under seaweed); also Orca, Prince William Sound.

Characteristics. — This species and *L. merriami* were contained in the same bottle and must have come from the same locality and lived under the same conditions. From *L. merriami* this species could be readily distinguished by its deep intersegmental grooves, which give the body a decidedly annulated appearance.

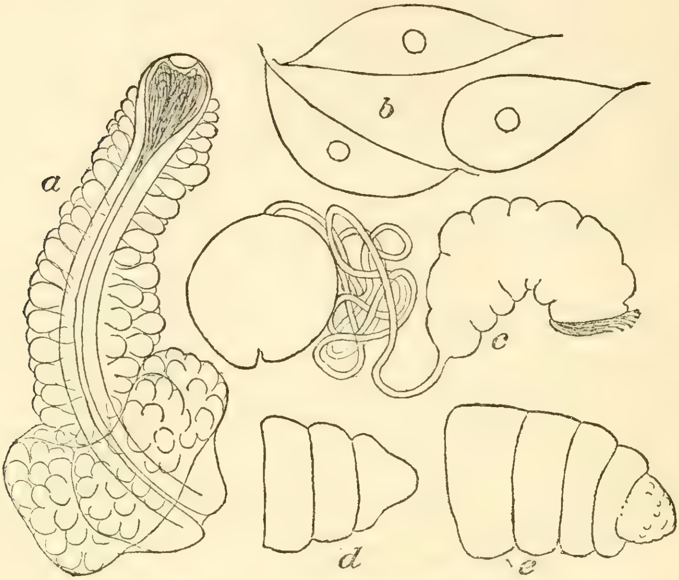


FIG. 50. *Lumbricillus annulatus.*

DETAILED DESCRIPTION.

Sexual papillæ. — They are prominently projecting in all the specimens in the collection. The structure of the penial bulb differs little or not at all from that found in other species, except in so far as the bulb seems to be capable of being greatly protruded.

Septal glands. — These glands, which are of large size, are clustered around the septa separating somites IV/V, V/VI and VI/VII.

Brain. — This organ varies considerably as regards width. Two figures are given of the extremes found by dissection.

Nephridia. — These organs are covered thickly with small bladder-like elevations to the extent that the inner ducts cannot be followed. There are no special granulations on the main body near the nephrostome. The inner duct seems to be wide.

Setæ.—In the majority of the fascicles, both the ventral and the lateral ones, the setæ next to the lateral interval are the smallest. In each fascicle the majority of the setæ are of about the same length.

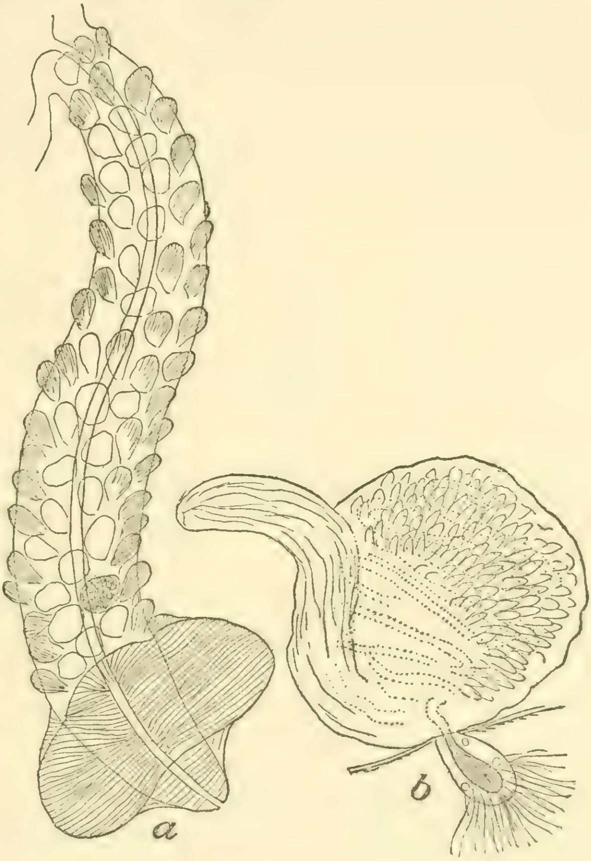


FIG. 51. *Lumbricillus annulatus.*

Spermathecæ (fig. 50, *a*). — The whole duct, up to the very connection with the intestine, is covered with glandular cells grouped in papillæ-like bunches, giving to the spermatheca an uneven and warty outline. The basal glandular collar has, however, a perfectly even outline, and the outline of the various cell-groups do not in the least project exterior to the general margin of the collar. The cells in the collar are somewhat narrower than those in the envelope of the duct. The chamber of the ampulla, which is full of spermatozoa, is entirely confined to the lumen of the duct and does not cause a bulging out as in some other species.

Ventral glands. — As has been stated in the definition, large ventral glands are found in XIV to XIX. These posterior glands are of about the same size — about one and a half to two and a half times as wide as the diameter of the ventral nerve cord. They are wing-like and do not bend over the ganglion but stand out laterally. In the anterior somites from XI to II, cross-sections show that the large dark staining cells, which form an integral part of the ganglion, and which do not project outside of the ganglionic lining, send down ducts through the body-wall and through the epidermis in exactly the same manner as do the ventral glands posterior to the clitellum. The only difference seems to be that the anterior cells in question are smaller and fewer in number and confined to a much smaller space. Posterior to the clitellum the area perforated by the ducts is equal to about one-half the length of the somite, while in the anterior somites the area is perhaps only one-fifth of the length of the somite. There is probably no great functional difference between the two sets of cells.

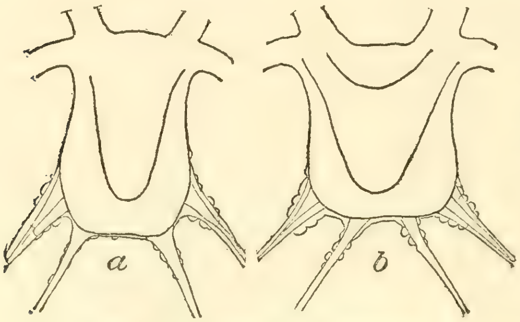


FIG. 52. *Lumbricillus annulatus.*

Lumbricillus annulatus from Orca. — The specimens from Orca differ in a few slight particulars from those from Metlakatla. The spermathecæ are slightly longer and without any trace of an inner chamber for the reception of the spermatozoa. The color is pure milky white. The prostomium is more rugose and somewhat more pointed than in the specimens from Metlakatla. In other respects the specimens from the two localities resemble each other.

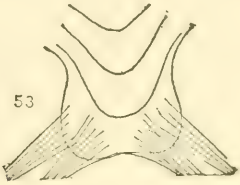
The size and shape of the glands lining the duct of the spermathecæ vary almost indefinitely. In some specimens the agglomerations are small and far from each other, in other specimens they are large and crowd one another.

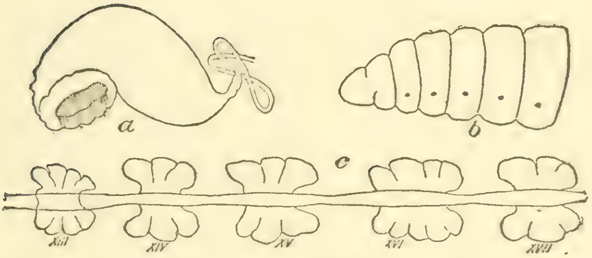
LUMBRICILLUS RITTERI sp. nov.

Pl. XIII, figs. 5–9; text-figs. 53 and 54.

Definition. — Length 25 mm. or less, width 2.5 mm. or less. Somites about 60. Prostomium rounded and short. Somite II narrow. Setæ typical: ventral, 9, 8, 9, 9, 8, 8, 8, 8, 7, 7, 0 (XII), 5, 5, 5, 5, 5, 7, 5, 5, etc.; other specimen: ventral, 5, 5, 5, 5, 6, 6, 6, 5, 6, 7, 0 (XII), 5, 5, 5, 4, 4, 5, 5, 6, 5, etc.; lateral, 5, 5, 5, 5, 6, 6, 6, 5, 6, 5, 0 (XII), 5, 5, 5, 4, 4, 5, 4, 4, etc.; second specimen: lateral, 3, 3, 4, 4, 3, 4, 4, 4, 4, 4, 0 (XII), 3, 3, 4, 4, 3, 4, 3, etc. Clitellum well marked. ½ XI, XII, and XIII. Sexual papillæ small. Septal glands typical. Brain almost square or slightly oblong, posteriorly almost straight with a shallow emargination, the anterior arms thick. Dorsal vessel rises posterior to clitellum. Spermathecæ with a thick apical ampulla and with a narrow duct, which is covered both at its base and all along its sides with accessory glands; the ampulla connects with the intestine. Sperm-ducts narrow, coiled in XI. Sperm-funnels thick and curved. Penial bulb oblong. Testes large, with many lobes capped by comparatively large sperm-sacs. Ovaries multilobed, large.

53





FIGS. 53 AND 54. *Lumbricillus ritteri.*

Ventral glands in XIII to XVII, the individual glands being comparatively small, about four or five times as wide as the ganglion. Nephridia with short anteseptal, posterior to which is the thick, opaque, granulated neck of the main nephridial body. Color of formalin specimens white, clitellum pink.

Locality. — Farragut Bay, Alaska, June 5, 1889, Prof. W. E. Ritter.

Characteristics. — The spermathecæ, the brain, and the ventral glands are all characteristic of the species. The spermathecæ possess glands not only at the base, but also along the muscular duct.

Testes. — Testes large and completely fill the somites in which they are situated. Consist of some twenty to twenty-five lobes each, each lobe being narrow, of rather even thickness, and at the apex capped by the usual sperm-sac.

Ovaries multi-lobed, large, occupying all the available space in somite XII.

Ventral glands (fig. 53, *c*).—The glands in the respective somites of nearly equal size; the most anterior one the smallest and the fourth in order the largest. The individual glands smaller than in *L. franciscanus* and in *L. santæclaræ.*

Setæ.—The number of setæ in the fascicles seems to be variable. Of the two counts given the higher number is the most common.

LUMBRICILLUS FRANCISCANUS sp. nov.

Pl. XIII, figs. 1 and 2; text-figs. 55–57.

Definition.—Length 10 to 12 mm., width .75 mm. Somites 39 to 58. Setæ: ventrals, 6, 5, 4, 3; laterals, 4, 3, 3, 2. The lateral interval about double the width of the ventral interval. The setæ in each bundle of nearly equal size. Head-pore large, between prostomium and somite I. Prostomium round, blunt. Clitellum XII and XIII. Copulative papilla small. Septal glands in IV to VI. Brain strongly emarginated posteriorly, about thirty units long by fifteen wide at center. Dorsal vessel rises in XIV or XV. Intestine with a thin layer of chloragogen cells. Spermatheca with an oval ampulla and a thin straight duct, the latter surrounded along its whole length by a conical shaped agglomeration of glands. Sperm-ducts thin and long. Sperm-funnels about twice as long as thick. Ventral glands in somites XIV, XV and XVI, increasing in size posteriorly. Ovaries in XII, testes in XI. The testes lobes are short, rounded, pear-shaped. Nephridia are longer than broad. Lymphocytes oval, varying considerably as regards size.

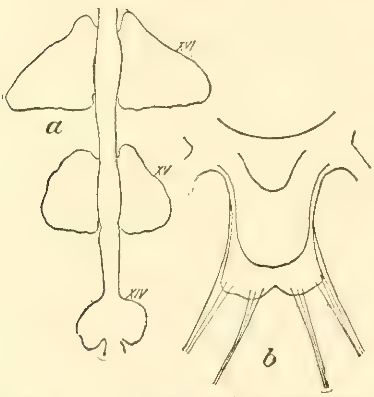


Fig. 55. *Lumbricillus franciscanus.*

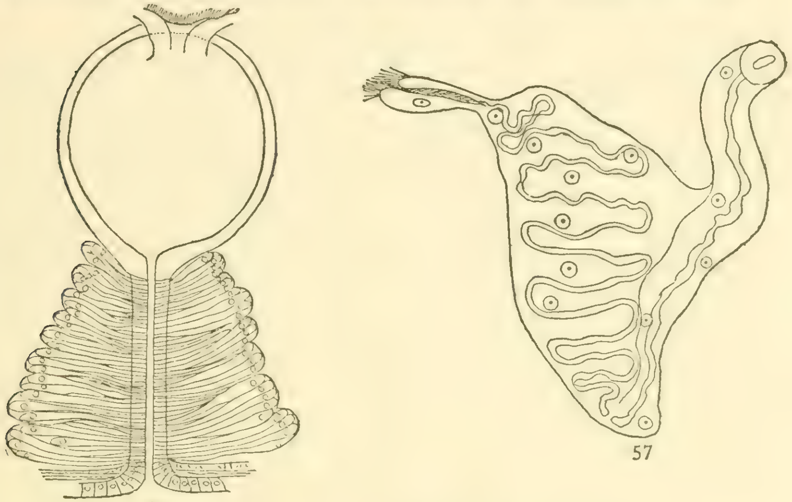
Locality.— Santa Clara River, California, in the moist soil of the banks.

Characteristics.—The species is distinguished principally by the form of the spermatheca and the glands at the base. In *P. santæ-*

claræ these glands are in the form of a thin disk and confined to the very base of the spermatheca, while in this species the glands extend all the way up to the pouch. The species is also characterized by its many ventral glands, these being present in three somites.

DETAILED DESCRIPTION.

Somites. — There is a great variation in the number of somites, the smallest adult worms possessing only 39, while the largest one had as many as 58. As I did not possess a sufficient number of the smaller size I must leave it to the future to ascertain whether perchance there are other differences between the larger and the smaller specimens.



FIGS. 56 AND 57. *Lumbricillus franciscanus.*

Septal glands. — These are thick and rounded, and the septal part is about equal to the interseptal part.

Dorsal vessel has already risen in XVI. How much further it extends posteriorly I do not know, as I did not section further. In that somite it is large and covered with long chloragogen glands. Similar glands also surround the intestine throughout its length.

Spermathecæ (fig. 56).—The ampulla is rounded, oval, or sometimes a little pointed. The opening connecting with the intestine is not at the apex but a little below it. The walls of the ampulla are thin. The duct is straight, cylindrical, and of even thickness. It is covered along its whole length with glands which are much longer at the base of the spermatheca than at the junction with the ampulla. The duct and ampulla are of about the same length.

Sperm-ducts are thin, long, and much coiled, and confined to somite XII. The *funnels* are thicker than in *L. santæclaræ*, and also shorter. The penial bulb is globular. The sperm-duct enters on the outer side and remains free inside the bulb for a considerable distance. Only the lower fourth is covered with long and thin glands (pl. XIII, fig. 1). There are also two sets of penial glands opening close to the sperm-duct, but enclosed in the penial bulb. In *L. santæclaræ* the glands cover the sperm-ducts along three-fourths of their entire length inside the penial bulb.

Testes are strongly racemose and the lobes are rounded and pear-shaped. The lobes are more rounded and less pointed than in *L. santæclaræ*. Each lobe is covered with its own sperm-sac.

Ventral glands.—This species possesses ventral glands attached to the ventral ganglion in each one of somites XIV to XVI. The glands are larger, increasing posteriorly, and extend far out into the cœlom (pl. XIII, fig. 2), being four to five times as long as the ganglion is wide. In the posterior one of these somites the glands enclose the ganglion almost completely.

Lymphocytes.—These do not exist in all specimens. Thus the specimen sectioned did not contain any lymphocytes, while in a dissected one there were many.

Nephridia.—The duct very thick and comparatively short, varies considerably in the respective nephridia. There may be segregated two types, one with thick duct, and one in which the duct is narrower and also a little longer.

LUMBRICILLUS FRANCISCANUS BOREALIS var. nov.

Text-fig. 58.

Definition.—Length 15 mm., width 1.25 mm., all contracted specimens. Somites 62. Setæ sigmoid, the outer one in the ventral fascicles and the inner one in the lateral fascicles much smaller than the other: laterals, 4, 5, 5, 5, XIII, 3, 4, 4, 4, 3; ventrals, 6, 7, 7, 7, XIII, 4, 4, 4, 4, 3. Head-pore between prostomium and somite I. Clitellum XII and XIII. Copulative papilla small. Salivary glands large, IV to VI. Brain almost square, broader anteriorly; anteriorly slightly emarginated, posteriorly considerably emarginated. Spermatheca with a duct and an ovoid ampulla, the former surrounded along its whole length with glands, broadening toward the base. Sperm-ducts narrow, confined to somite XII. Sperm-funnels broad and slightly curved. Penial papilla more oblong than in the species. The lobes of the testes are oblong, pear-shaped, with rounded sperm-sacs. Ventral glands in XIII, XIV and XV, those in the last two much larger than the one in XIII. The glands are larger than in the species. Nephridia with a thick duct. The middle lobe with slightly lobed margin. Color pale yellowish white (alcoholic specimens).

Locality.— Two mature and three immature specimens from St. Paul Island, Pribilof group, Alaska, Prof. Trevor Kincaid (August).

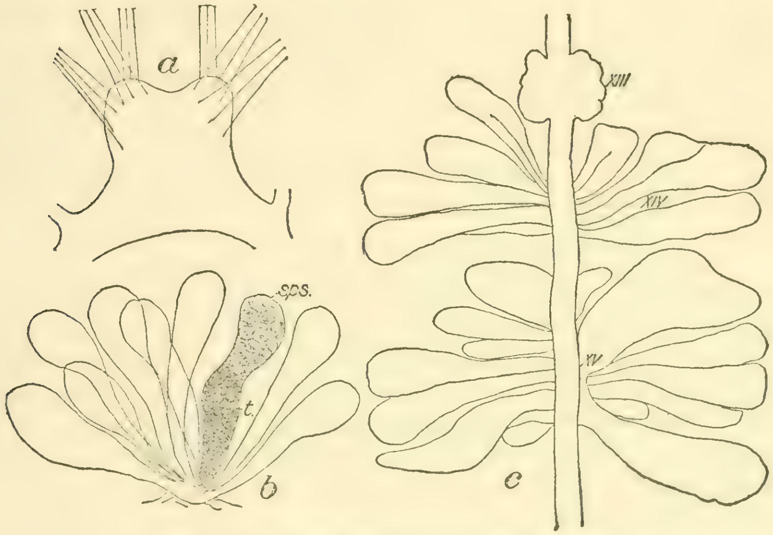


FIG. 58. *Lumbricillus franciscanus borealis.*

Characteristics.— The principal differences between this variety and the species are as follows: The ventral glands are considerably larger in the variety. The setæ in the species are of about equal size in the same fascicle. In the variety *L. borealis* the inner setæ in the lateral fascicles and the outer seta in the ventral fascicles are markedly smaller than the other setæ in the same fascicle. The width of the variety is about twice that of the species. The ventral anterior fascicles contain one more seta in the variety.

LUMBRICILLUS FRANCISCANUS UNALASKÆ var. nov.

Text-fig. 59.

Definition.—Length 17 mm., width 1.2 mm. Somites 72. Setæ sigmoid, all of the same size in fascicle: ventrals, 4, 6, 6, 6, 6, 6, 6, 6, 6, 0 (XIII), 3, 5, 5, 4, 4, 3; laterals, 5, 4, 5, 5, 5, 5, 4, 3, 3, 3, 3 (XIII), 2, 3, 3, 3, 3. Brain square, posteriorly truncate, anteriorly slightly emarginate. Color bright ochraceous yellow (alcoholic specimens). Ventral glands very large (but not as large as in *L. franciscanus* var. *borealis*), in XIII and XIV. Lymphocytes large, oval, pointed, numerous. In other respects similar to the species.

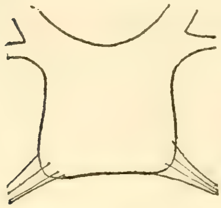


FIG. 59. *Lumbricillus franciscanus unalaskæ.*

Distribution. — Unalaska, Prof. Trevor Kincaid (September).

Characteristics.—The squareness of the brain and the fact that all the setæ are of the same size in each fascicle distinguishes this variety from *L. f. borealis.* From the species it differs principally in size and in the form of the brain. As regards the number of setæ, this variety stands between the species and *L. f. borealis.*

Genus **Marionina** Michaelsen.

Definition. — Setæ sigmoid, as in *Lumbricillus.* Head-pore small, between prostomium and somite I. No dorsal pores. Blood red or yellow. Dorsal vessel rises posterior to clitellum. No cardiac gland. No peptonephridia. Sperm-ducts comparatively long and narrow. Penial bulb without interior muscular strands. Testes undivided, each covered by a small sperm-sac. Ventral glands present or absent. Nephridia with entire postseptal and with comparatively large head-like anteseptal.

To the original definition of this genus I have added the characters concerning the testes and their sperm-caps and the structure of the penial bulb. The principal difference between *Marionina* and *Lumbricillus* concerns the testes, as is now well known. But I think that another difference may be derived from the nephridia, which in *Marionina* seem to be characterized by a large head-like anteseptal, while in *Lumbricillus* the anteseptal consists of merely the nephrostome.

DETAILED DESCRIPTION.

Penial bulb. — The penial bulb resembles that of *Lumbricillus* in general structure. There are two sets of glandular cells opening in the bulb. One set opens into the lower part of the sperm-duct, while the other opens onto the base around the pore.

Nephridia. — These organs have not been described in all species and general conclusions cannot therefore be made for the present. There seem, however, to be two types, one with a short anteseptal consisting of a mere nephrostome, while the other type possesses a large anteseptal, almost equalling in size the postseptal lobe. So far as I know, the latter type of nephridia has not been described in *Lumbricillus*.

SYNOPSIS OF SPECIES OF MARIONINA DESCRIBED IN THIS PAPER.

I. SPERMATHECA WITHOUT DIVERTICLES.
Spermatheca with long duct and with an ampulla which is contracted at several points. Interior of spermathecal duct ciliated. Ventral glands in X and XI. Nephridia with large anteseptal .... 1. *M. alaskæ* sp. nov.

II. SPERMATHECA WITH TWO DIVERTICLES:
Spermatheca with a long duct at the base of which are a few small glands. Head-pore immediately in front of the groove between prostomium and somite I. No ventral glands .... 2: *M. americana* sp. nov.

MARIONINA ALASKÆ sp. nov.

Pl. XIV, figs. 2–6; text-fig. 60.

Definition.— Length 12 mm., width .85 mm. Somites 53. Prostomium blunt and rounded. Setæ sigmoid: ventrals, 4, 6, 6, 7, 5, 6, 6, 5, 6, 4, 0, 5, 4, 5, 4, 3, 4, 5, etc.; laterals, 3, 4, 5, 6, 5, 5, 5, 5, 5, 4, 0, 4, 4, 3, 3, 3, 3, 4, 3, etc. Head-pore small between prostomium and somite I. Dorsal pores (?) in II, III and IV. Clitellum dorsally XII and XIII, ventrally XII, ½ XIII. Sexual papillæ distinct. Septal glands in IV to VI. Dorsal vessel rises in XII. Intestine gradually increasing in size; no diverticles. Spermathecæ large, with narrow, strongly muscular duct and a wider ampulla, which is continued as a narrow thin-walled duct until its junction with the intestine in VI/VII. Sperm-ducts narrow and long. Sperm-funnels about three times as long as wide. Penial bulb with two kinds of glandular cells opening into the sperm-duct and around the pore. No ovisacs. Ventral glands in X (and perhaps in XI). Nephridia with large anteseptal in which the duct is coiled. Lymphocytes large, circular and disc-shaped. Color of alcoholic specimen yellow. No pigment.

Locality. — Port Clarence, Alaska, Dr. Anton Stuxberg, Vega Expedition (July 26, 1878). A single specimen.

Characteristics. — The form of the spermatheca, with its narrow duct connecting with the intestine, and with its three basal glands, seems fully to characterize this species.

DETAILED DESCRIPTION.

On account of the want of specimens for dissection, the form of the brain remains unknown.

Body-wall.— The circular muscular layer consists of cells arranged on the nematode plan as described by Hesse (1). The plates are set at a rather wide angle (Pl. XIV, fig. 2).

Spermathecæ (pl. XIV, figs. 3 and 4). — The long muscular duct is covered exteriorly by parallel muscular strands. Viewed in cross-section it is seen that the strands are separated one from the other. The narrow duct of the ampulla is continued parallel to the intestine as far as the septum VII/VIII, where it enters the intestine. There are three large basal glands which enter the somewhat enlarged duct.

Sperm-funnel and duct. — The funnel is about twelve times as wide as the duct. The latter is confined to somite XII.

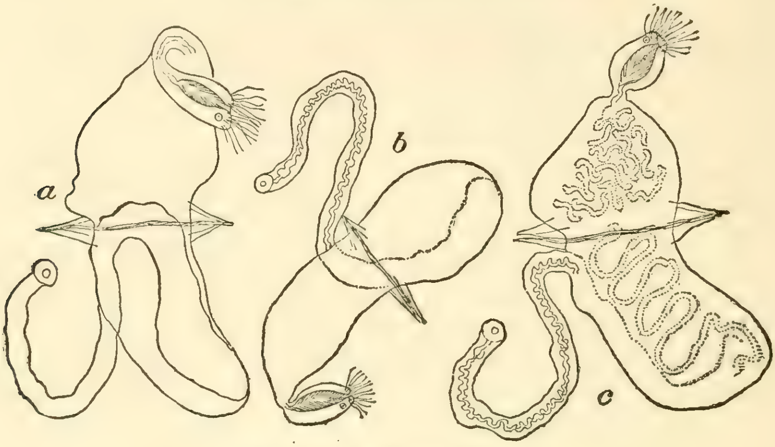


FIG. 60. *Marionina alaskæ.*

Nephridia (fig. 60). — The anteseptal is very broad and almost as long as the main body of the postseptal. The duct is either strongly coiled in the anteseptal or forms a network of anastomosing ductules. The nephridia are somewhat variable in shape. The figures are all from nephridia posterior to clitellum.

Dorsal pores. — There is considerable doubt as to the presence of the dorsal pores. Close in front of the septa of the four anterior somites there is a structure closely resembling the cells which generally surround dorsal pores, but I have been unable to see the respective openings. Hence the question mark in the definition.

Papillæ. — There are two exterior papillæ anterior to the male pores, one ventral and situated somewhat to one side of the median line in XI, the other in somite VI also slightly on one side of the median ventral line. My longitudinal sections did not show their structure.

Setæ. — The setæ are slightly sigmoid. The ventral setæ diminish in size toward the ventral interval, while the lateral setæ diminish in size toward the dorsal interval.

MARIONINA AMERICANA sp. nov.

Pl. XIV, fig. 1; text-figs. 61 and 62.

Definition.—Length 10 mm., width .5 mm. Somites about 50. Prostomium blunt. Setæ: ventrals, 2, 2, 2, 2, 2, 3, 3, 2, 2, 2, 0, 2, 4, 4, 4, etc.; laterals, 2, 2, 2, 2, 3, 2, etc. Head-pore immediately in front of the groove between prostomium and somite I. Clitellum small, XII and XIII. Sexual papillæ small, cylindrical, truncate. Brain posteriorly slightly emarginate; posteriorly much broader than anteriorly. Dorsal vessel rises posterior to clitellum. Intestine with few and thin chloragogen cells. Spermathecæ consist of a narrow and comparatively long duct, and a short and wide ampulla furnished with two short diverticles; the ampulla does not seem to connect with the intestine. The penial bulb contains two kinds of glandular cells, one kind being more granular and staining more deeply than the other. Spermduct narrow and coiled, confined to XII and XI. Testes entire, but covered by a cap-like sperm-sac confined within XI. No ovisac. No ventral glands. Lymphocytes large, rounded, disk-like. Color pale, without pigment.

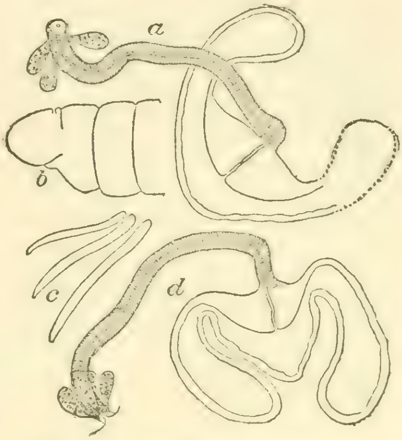


FIG. 61. *Marionina americana.*

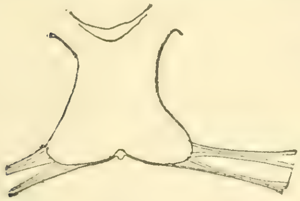


FIG. 62. *Marionina americana.*

Locality.—Port Clarence, Alaska, Dr. Anton Stuxberg, Vega Expedition (July 23 to 27, 1879). A single specimen.

Characteristics.—The single specimen being in a poor state of preservation prevented any detailed investigation. The anterior part of the worm was sectioned transversely. The nephridia are not in a sufficient state of preservation to allow their finer structure to be satisfactorily studied. The spermatheca is distinctly characteristic of the species.

Setæ.—The setæ of the ventral fascicles diminish in size toward the ventral interval, while those of the lateral fascicles diminish toward the dorsal interval. The setæ are slightly sigmoid. An immature specimen, found in the same vial and possibly belonging to the same species, possessed an average of one more seta in each fascicle.

Genus **Bryodrilus** Ude.

Definition. — Setæ sigmoid. Head-pore between prostomium and somite I. No dorsal pores. Esophagus gradually emerging into the intestine. Blood colorless. Dorsal vessel rises in the clitellum; with or without cardiac gland. Peptonephridia rudimental. Testes solid. No sexual ventral glands. Spermathecæ connected with the intestine. Penial bulb without interior muscular strands. Intestine with four diverticles in somite VIII. Nephridia with branched inner duct.

Penial bulb. — The penial bulb in the present species of *Bryodrilus* is built on the same principle as in *Fridericia* and *Lumbricillus* though it is somewhat more complicated, as will be described more in detail under the species. Here it is sufficient to point out that there are two sets of glands, one opening into the sperm-duct, the other in small depressions on the base of the bulb.

Nephridia. — They are of the *Enchytræus* type but the ducts are more complicated, being much branched (at least in one species). The anteseptal consists of a mere nephrostome.

SYNOPSIS OF SPECIES OF BRYODRILUS.

Setæ distinctly sigmoid, 3–5 in each fascicle. Brain posteriorly convex.
1. *B. ehlersi* Ude.
Setæ indistinctly sigmoid, 2 in each fascicle. Brain posteriorly emarginate.
2. *B. udei* sp. nov.

BRYODRILUS UDEI sp. nov.

Pl. XII, figs. 1–4; text-fig. 63.

Definition. — Length 25 mm., width 1.25 mm., somites 56, or length 25 mm., width .75 mm., somites 75. Setæ almost straight and short; in couples; eight in each somite. Head-pore between somite I and prostomium. Clitellum dorsally and ventrally XI, XII and XIII. Copulatory papilla distinct, and rounded or truncate, with a longitudinal slit at apex. Ovipores elevated. Septa not thickened. Septal glands in IV to VI. Salivary glands (?) rudimentary. Brain slightly longer than wide, emarginated both anteriorly and posteriorly. Dorsal vessel originates in XII and is furnished with a cardiac gland. Intestine with a thin layer of chloragogen cells. Four intestinal diverticles in VIII connecting with the intestine at the posterior septum. Spermathecæ without diverticles, grown together at apex and opening through a common duct into the intestine. Sperm-ducts very narrow, confined to somite XII. Funnels large, longer than wide, in XI. No sperm-sacs and no ovisacs. No prostates, but small and numerous penial glands confined by the peritoneum and the penial bulb. No ventral glands. Ovaries in XII and testes in XI. Nephridia with a short anteseptal, a rectangular central lobe, and a long duct. Lymphocytes round, flat, about one-third the width of the short diameter of the nephridium.

Locality. — Port Clarence, Alaska, July 23–26, 1878. Dr. Anton Stuxberg, Vega Expedition.

Characteristics. — This species is readily distinguished from the type species, *B. ehlersi*, by its large intestinal diverticles, its brain, which is emarginated both posteriorly and anteriorly, and by its setæ, which are so short that they cannot be studied on undissected specimens. Their number is also characteristic, there being only two in each bundle.

DETAILED DESCRIPTION.

Size. — It is remarkable that the relative length and width should vary to such extent that with the same length some specimens are but half as wide as others. I suspected at first that I had before me two distinct species, but I am unable to distinguish any characteristics that would accompany the difference in size. There are in all eight specimens in the collection, two of which are thick, the others thin. One of the thick specimens was sectioned longitudinally, while of the thin ones one was sectioned transversely and one was dissected.

Somites. — The body is of an even thickness and the somites though distinct are hardly set off from each other, the intersegmental grooves being exceedingly shallow. This gives the body a smooth, even, and glossy appearance. It is to be remarked that the thin specimens possess the largest number of somites.

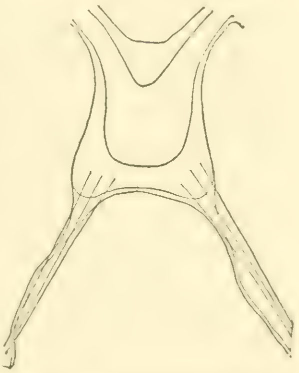


FIG. 63. *Bryodrilus udei.*

Setæ. — The setæ are not distinctly sigmoid but almost straight. They are also very short (Pl. XII, fig. 3*a*). They begin with somite II, and are arranged in couples, there being thus eight in each somite, except in the last, where there are only four.

Copulative organs. — The exterior papilla short, broad and truncate, with a longitudinal slit at the apex into which open the sperm-duct and the penial glands. Behind the papilla lies the penial bulb, enclosed and confined by the peritoneum. It is thus sharply defined toward the cœlom, into which it slightly projects. The center of the bulb is occupied by the penial part of the sperm-duct, while on each side of the latter there are two groups of penial glands opening respectively by two pores, one in front of and one posterior to the spermiducal pore proper. The glands which open in the lower part of the sperm-duct inside the bulb are covered by thin strands of muscles, thus giving the appearance of a bulb within a bulb. This arrangement resembles that in *Mesenchytræus*, but is not found in any other species of the subfamily of Lumbricillinæ. But the arrangement of the glands which open in the lower part of the sperm-duct is in other respects similar to that found in the genera *Henlea* and *Fridericia*, as well as in *Marionina*. In *Mesenchytræus* only few species possess similar glands which open in the lower part of the sperm-duct, while in Lumbricillinæ such glands are found in all the species examined by me. No atrium and no atrial glands. The sperm-duct very narrow and repeatedly convoluted, but owing to the fact that it is confined to somite XII, it cannot be more than three or four times as long as the sperm-funnel. The latter is longer than broad and points forward, being confined to somite XI. This latter is full of spermatozoa and the septum X/XI is pushed far forward against the intestinal glands in VII.

Testes solid and quite large.

Spermathecæ.— These organs appear to resemble those of *B. ehlersi* described by Ude. The duct is long, narrow and even as to thickness. It opens into a thin-walled sac which lies principally in VI. The two sacs are grown together and continued as a narrow duct, which at first runs parallel to the intestine and then penetrates it somewhere in somite VII, probably in the posterior part of the somite close to the septum VII/VIII. The spermathecæ open exteriorly, as usual, at the opposite ends of the transverse diameter of the body. They are not accompanied by any glands.

Septal glands. — These offer no particular characteristics. They are of large size and are partly attached to the septa and partly lie free in the cœlom. They open into the intestine just behind and on each side of the pharynx (Pl. XII, fig. 1, *gln*).

Salivary glands. — In this species I find structures corresponding to those described by Ude in *B. ehlersi* as strongly rudimentary salivary glands. It seems to me more probable that these small compact bodies are of a ganglionic nature and not glandular. There is no duct and no indication of any secretion. Moreover, a part of their mass lies wholly in the septal gland and resembles greatly the structure which Michaelsen (3) has described as ganglionic in the septal glands of *Mesenchytræus setosus*. In *B. udei* these ganglia are oblong or pear-shaped and lie close together on the dorsal median line just behind the pharynx. Posteriorly they extend into the septal glands, while anteriorly they continue forward into two fibrillar bands, which I take to stand in connection with the main nervous system. These structures do not resemble the peptonephridia of the other genera.

Brain very different from that of *B. ehlersi*. The posterior margin is emarginated and the brain is slightly longer than broad.

Dorsal vessel, just as in *B. ehlersi*, rises in somite XII from a fold in the intestine, and does not in any way connect with the intestinal diverticles. There is a heavy blood sinus in the gut in somite V.

Intestine. — The most interesting part of the intestine is the four diverticles situated in VII. In Ude's original paper ('93) the diverticles of the species are described by him as being situated in VII, but in a later ('95) and more elaborate paper this is corrected to VI. In my specimens of *B. udei* it is not easy to decide upon the somite containing the diverticles, as the tender septa are somewhat ruffled on account of sand in the intestine, but I am certain that they cannot be referred to VI. They are either in VII or in VIII, more probably in VIII. The diverticles are larger than in Ude's species and differ also from it in originating in the posterior part of the somite near the posterior septum. They project forward, being parallel with the intestine and are grown together with the gut in VI, but do not open into it. The diverticles are wider than the intestine between them and of the same structure. They are arranged latero-dorsally and latero-ventrally. Their inner epithelium is in places much thicker, and is everywhere ciliated.

Lymphocytes. — These are large, flat, circular or slightly oval, and about one-third as wide as the nephridia.

Nephridia. — There are two forms, one with a kind of posterior fold almost separated from the rest, and one with only one rectangular fold. The duct is long, while the anteseptal is very short, consisting merely of the nephrostome. Postseptal duct projects from posterior end.

Habits. — The label contains no notes as regards the habits of this worm, but the intestine contained fragments of moss and much sand, and there is every reason to suppose that the habits are terrestrial.

Genus **Henlea** Michaelsen.

Definition.— Setæ variable (like *Fridericia* or *Lumbricillus*). Head-pore small, situated between prostomium and somite I. No dorsal pores. Esophagus narrow and suddenly merges into the intestine. Intestinal diverticles generally present. Dorsal vessel rises anterior to the clitellum. Blood colorless. Lymphocytes large, disc shaped. Brain posteriorly emarginated. Nephridia generally with large anteseptal. Spermathecæ generally without diverticles. Sperm-ducts comparatively narrow and long. Penial bulb without interior muscular strands (*Lumbricillus* bulb). Chylus cells in the intestine in the vicinity of clitellum.

Affinities.— The genus *Henlea* as now established is undoubtedly nearest related to *Bryodrilus*. Both genera agree in the most remarkable variation in the various organs. The only real distinction between the two genera lies in the origin of the dorsal vessel. In both genera we find a variation in the form and comparative length of the setæ. These may be either sigmoid (*Lumbricillus*-shaped), straight (*Enchytræus*-shaped), or straight and of uneven size (*Fridericia*-shaped). The nephridia of the new species are characterized by large anteseptal, probably characteristic of the genus. Salivary glands may be absent, rudimentary, or much enlarged. Even the structure of the penial bulb seems similar in the two genera. The structure is characterized by its two sets of glands, some of which open into the sperm-ducts, while others open into small pore-like depressions on the surface around the base of the penial pore. The presence of intestinal pouches seems to be the rule, there being only a single exception. I have followed Michaelsen in referring *H. dicksoni* to this genus, but I am doubtful as to its correctness. The absence of intestinal pouches, and a small anteseptal distinguishes that species from all others in this genus. These two characteristics are of so great importance that we may well doubt the systematic place of that species.

SYNOPSIS OF THE SPECIES OF HENLEA.

I. TWO PAIRS OF SPERMATHECÆ, IN IV AND V.

Spermatheca without distinctly differentiated ampulla and without diverticles. Setæ in ventral fascicles 8 to 10, in lateral fascicles 5 to 7, arranged in a fan-shaped manner .... 1. *H. puteana* Vejd.

II. ONE PAIR OF SPERMATHECÆ ONLY, IN V.

1. Spermathecæ without diverticles.

Spermatheca slender, with the ampulla hardly wider than the duct. The inner setæ in each fascicle smaller. Brain posteriorly concave. Two large intestinal pouches in VIII. Anteseptal comparatively small. Large peptonephridia .... 2. *H. californica* sp. nov.

Spermathecæ with distinctly differentiated ampulla. Large peptonephridia. The setæ of nearly equal length or slightly *Fridericia*-shaped. Anteseptal narrow and comparatively small. Brain posteriorly emarginated. Two large intestinal pouches in VIII/IX .... 3. *H. leptodera* Vejd.

Spermatheca with distinctly differentiated ampulla and with a duct nearly three times as long as the pouch. Peptonephridia present. Setæ 6 to 8, the inner ones shorter. Anteseptal narrow and small, brain posteriorly emarginated. No intestinal pouches..................... 4. *H. dicksoni* Eisen.

Spermatheca with distinct ampulla tapering toward the intestine. No peptonephridia. Setæ variable, generally straight, of equal size, or the inner ones shorter. Anteseptal rather long and narrow, cylindrical. Brain posteriorly deeply notched. Four large intestinal pouches in VIII/IX.
5. *H. ventriculosa* d'Udek.

Spermatheca with a distinct ampulla gradually tapering toward the intestine. Peptonephridia large. Setæ about six in a fascicle, the inner ones shorter. Anteseptal broad and large. Brain posteriorly emarginated. Two intestinal pouches in VII/VIII.............................. 6. *H. guatemalæ* sp. nov.

Spermatheca with pear-shaped ampulla, and twice as long as duct. Peptonephridia present. Setæ 4–7, rarely 2–3, straight, of equal length or the inner shorter. Postseptal long and with long duct projecting from its anterior end. Brain posteriorly emarginated. Two intestinal pouches in VII/VIII... 7. *H. nasuta* Eisen.

Spermatheca with central ampulla three times wider than duct. Peptonephridia short, undivided. Setæ straight, of equal length, ventrally 7–8, dorsally 5. Postseptal broad, flat, posteriorly emerging into the duct. Brain posteriorly truncate. No intestinal pouches............ 8. *H. rosai* Bretsch.

II. Spermathecæ with two distinct diverticles.

Setæ 4 in the fascicle, the inner ones much shorter. Large peptonephridia. Anteseptal very large and broad. Brain posteriorly convex. Intestine with two large pouches in VIII/IX, extending into VII.
9. *H. ehrhorni* sp. nov.

HENLEA CALIFORNICA sp. nov.

Pl. XV, fig. 1; text-fig. 64.

Definition.—Length 8 mm., width .75 mm. Somites about 60. Setæ of unequal length in the fascicle, from 4 to 6. No dorsal pores. Prostomium narrow and pointed. Clitellum prominent, XII and XIII. Sexual papillæ small but distinct. Supra-pharyngeal glands small. Septal glands prominent, in V, VI and VII. Peptonephridia begin in IV, closely adhering to the tubular intestine. Brain wider than long, posteriorly as well as anteriorly concave. Dorsal vessel rises in VIII. No chloragogen glands on either blood vessels or intestine. Tubular intestine nipped by the septa; sacculated intestine begins in VIII. Two large intestinal pouches in VIII. Spermathecæ tubular, slightly bent, opening into the intestine, at the base furnished with about two accessory glands, no diverticles. Sperm-ducts narrow. Penial bulb with two kinds of glands, one opening into the spermduct, the other opening next to the sperm-duct, but all confined to the bulb. Nephridia with small, narrow anteseptal and without glandular collar. Lymphocytes large, disc-like, in cross-section shuttle-shaped. Color yellowish white.

Locality. — Santa Rosa, Sonoma County, California. Under oak trees near the city. May, 1893. All the specimens are adult.

DETAILED DESCRIPTION.

Characteristics. — This species seems to be well distinguished from nearly all other species by its broad brain and its unequal setæ. The spermathecæ, though tubular without any perceptibly enlarged terminal ampulla, are apparently fully developed. The species differs from *Henlea nasuta* Eisen by its more tubular spermathecæ.

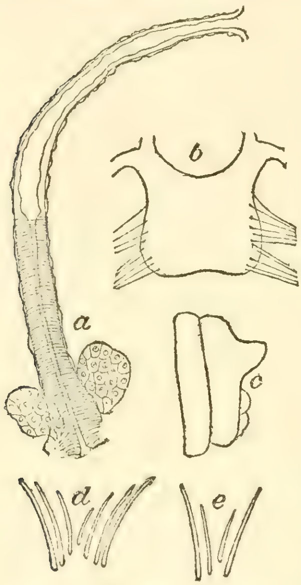


FIG. 64. *Henlea californica.*

Peptonephridia. — Judging from a series of longitudinal sections, these glands resemble the figure given by Vejdovsky of *H. leptodera* ('79, Taf. X, fig. 2). The basal part, however, is much larger and more irregularly folded, and the terminal tubules are fewer in number. The glands run close to the intestine and interior to the blood sinus in VII.

The intestinal pouches in VII are similar to those figured by Michaelsen from *H. nasuta* ('88, fig. 1). The villi are fully as intricately folded.

Spermathecæ are more cylindrical than those of *H. nasuta* Eisen ('79), to which species our present form seems closely related. Even as regards the setæ of the two species, *H. nasuta* and *H. californica* resemble each other greatly.

HENLEA CALIFORNICA MONTICOLA var. nov.

Text-fig. 65.

Definition. — Length 6 mm., width .65 mm. Somites 54. Brain about one-third wider than long. Setæ in fascicles of four, five and six. The setæ bordering the lateral interval are slightly longer. The spermathecæ, which are sharply bent, are furnished with four or more basal accessory glands. Color of formalin specimens white. In other respects similar to the species.

Locality. — West Fork of Feather River near Morgan Spring, Dr. Richard C. McGregor (Sept., 1898). The locality is in the Sierra Nevada at an altitude of several thousand feet.

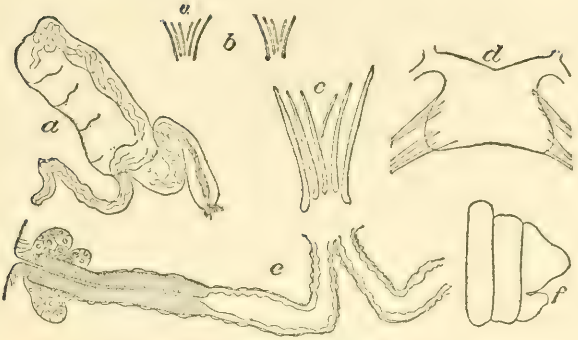


FIG. 65. *Henlea californica monticola.*

HENLEA CALIFORNICA HELENÆ var. nov.

Text-fig. 66.

Definition. — Setæ straight, in fascicles of four, five and six; the most ventral seta in the ventral fascicles and the one facing the lateral interval in the lateral fascicles are slightly larger than the others. Brain almost square with the posterior margin concave. Spermathecæ long and narrow with a central chamber for the spermatozoa and a long narrow duct communicating with the intestine; the inner lumen in this duct is narrow and tortuous. At the base of the spermathecæ are two long accessory glands. In other respects resembling the species.

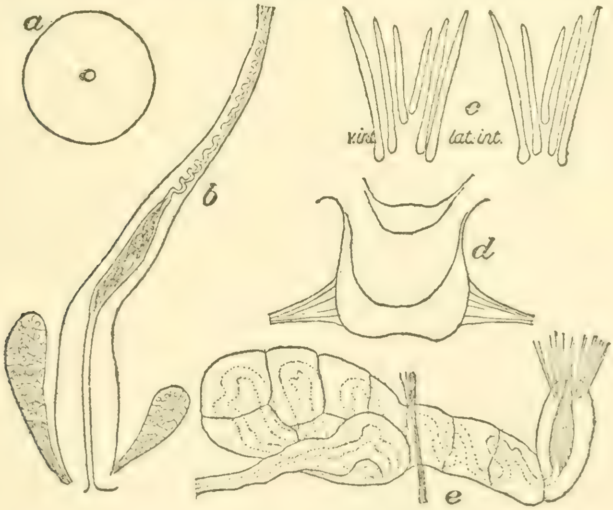


FIG. 66. *Henlea californica helenæ.*

Locality. — In the moist ground at a spring near St. Helena, Napa County, California, Dr. Richard C. McGregor. A single specimen.

Characteristics. — The most important characteristic concerns the long narrow duct of the spermathecæ and their inner tortuous duct. The nephridium is also characteristic, with its large anteseptal and very large nephrostome. As there was only a single specimen no attempt was made to section, and the above description is based on dissection only. The form appears so different that it will probably be found to be a distinct species.

HENLEA GUATEMALÆ sp. nov.

Pl. xv, fig. 7; text-figs. 67 and 68.

Definition.— Length 6 to 10 mm., width .75 mm. Somites 67, deeply set and everywhere distinct, prostomium pointed. Setæ straight and arranged fan-like; the most ventral seta of the ventral fascicles and the most dorsal setæ of the lateral fascicles are generally a little larger; otherwise the central setæ in each fascicle are the smallest. Clitellum thin and contracted. Sexual papillæ small and truncate-cylindrical. Septal glands in IV, V and VI. Peptonephridia large, with a thick and free basal part in III, and a thinner repeatedly folded part in IV to VII, the latter closely adhering to the intestine. Brain almost twice as long as wide, posteriorly emarginate. Dorsal vessel rises in VII in front of the diverticles of the intestine. Intestinal pouches in VII; epithelium with comparatively few folds. Spermathecæ consist of a slender duct about twice as long as the oval

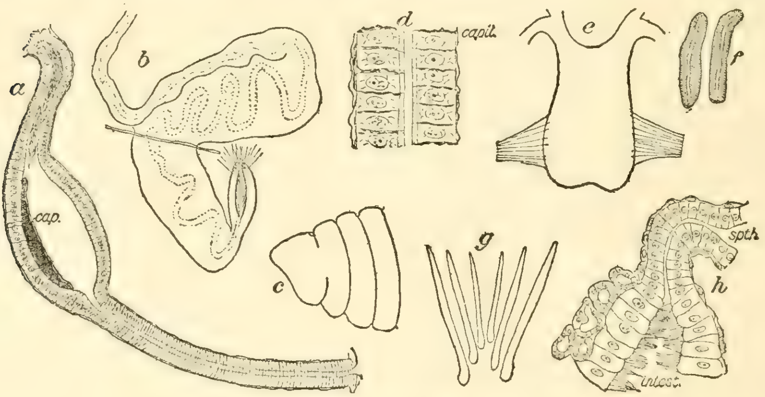


Fig. 67. *Henlea guatemalæ.*

ampulla, the distal end of which is narrow, tubular, and curved, opening into the intestine. Sperm-ducts are narrow, confined to one or two somites. Penial bulb with two sets of glands, all confined to the bulb. No chylus cells. Nephridia with large anteseptal in which the ducts are meandering. Color white.

Locality.— In garden soil in the City of Guatemala, Central America.

The occurrence of this genus in a tropical locality like Guatemala, even at an altitude of about 5000 feet would indicate that the species is introduced. So far as we know, all Enchytræids are of arctic or subarctic origin, none having been found endemic to the tropics.

DETAILED DESCRIPTION.

Spermathecæ (figs. 67, *a* and *h*).— An interesting feature is the large blood-vessel which is situated inside the spermatheca, lining the inner cavity. It is found only on one side of the cavity (fig. 67, *a*). Even the stalk of the spermatheca is filled with capillaries between the cells. The connection between the spermatheca and the intestine is narrow and twisted (fig. 67, *h*). It is possible that the length of the distal end is somewhat variable.

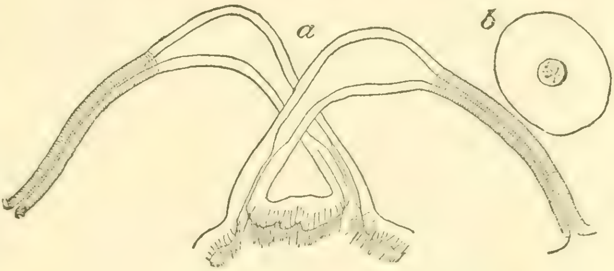


FIG. 68. *Henlea guatemalæ.*

Penial bulb.—In the penial bulb the coarsely granulated cells are situated exteriorly, opening on the surface around the pore. The narrower and more finely granulated cells open in the extension of the sperm-duct.

Somites.— The majority of the specimens measured 6 to 8 mm. These specimens possessed deep intersegmental grooves even posterior to the clitellum. Two specimens were longer, or about 10 mm. These were posteriorly smooth and showed no distinct intersegmental grooves posterior to the clitellum, except near the tail end. In these latter specimens the spermathecæ were slightly different in form but not sufficiently so to warrant the making of a distinct variety. The figure representing two spermathecæ crossing each other *in situ* is from these larger specimens (fig. 68, *a*).

HENLEA EHRHORNI sp. nov.

Pl. xv, figs. 2–6; text-fig. 69.

Definition.—Length 12 mm., width .5 mm. Somites about 67. The anterior few somites deeply pluri-ringed; the posterior ones, commencing with about VII, are smooth and indistinct. Setæ generally four in each fascicle, the inner setæ much smaller. The most ventral seta in the ventral fascicles and the most dorsal seta in the lateral fascicles are larger than the others. No dorsal pores. Head-pore large, between prostomium and somite I. Prostomium short, blunt, and rounded. Clitellum XII and XIII. Sexual papillæ small and square. Septal glands in IV to VI. Peptonephridia extending into VI. Brain oblong, posteriorly truncated, anteriorly convex. Dorsal vessel rises in VIII. Intestine tubular until VIII, in which somite it is furnished with two lateral diverticles. Sacculated intestine commences in IX. Spermathecæ with pyramidal ampulla and furnished with three knob-like diverticles. Penial glands of four kinds, confined to the bulb. Nephridia large, with large anteseptal; inner ducts of varying thickness. Lymphocytes large, as wide as the body-wall is thick, rounded-oval. Color yellowish-white.

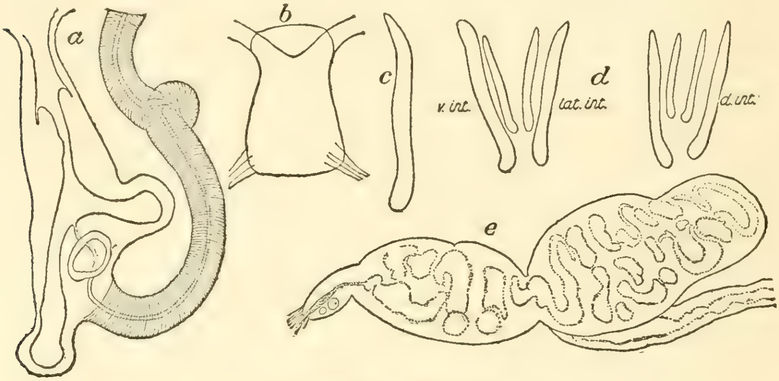


FIG. 69. *Henlea ehrhorni.*

Locality.—Mountain View, San Mateo County, California. Collected by Prof. Edward M. Ehrhorn, the well-known entomologist, for whom the species is named.

DETAILED DESCRIPTION.

Setæ.—The setæ are more curved in the anterior somites than in the posterior ones. The most ventral setæ are very much larger and especially thicker than the other setæ in the ventral fascicles. In *H.*

californica the setæ are of a more uniform size. The figures of the setæ of the two species are not drawn to the same scale, as their respective size is not particularly characteristic. The most ventral setæ in the ventral fascicles are more blunt than the other setæ.

Peptonephridia. — The specimen which was sectioned showed the typical arrangement of the peptonephridia, that is, the glands were closely adhering to the intestine. In somite III the glands show several short lobes projecting free out into the cœlom. In somite IV the gland is thin and shows no free lobes. But in V short lobes begin to appear, and in VI they are more numerous, their free projections being about as long as the intestine is wide. In the specimen that was dissected the two salivary glands (pl. xv, figs. 2, 3) were folded on themselves, projecting forward and not in any way adhering to the intestine. Their shape, however, so far as can be judged from a comparison with the sectioned glands, resembles the latter in all particulars except location.

Intestine. — The tubular part is furnished in VIII with a pair of diverticles which not only fill the largest part of VIII but also project into VII. The inner lobes of the diverticles are much coarser than in *H. californica*, the villi being less numerous and more of the nature of those of the diverticles of *Benhamia.* At the posterior end of the diverticles there is a large valve opening into the sacculated intestine. The epithelium of the tubular intestine is twice as thick as that of the sacculated intestine.

The *sperm-funnels* are short and ovoid. The sperm-ducts are narrow and apparently confined to the clitellar somites.

Penial papilla. — There are four kinds of glandular cells. Two kinds open into the sperm-duct, while two open into a small pore immediately in front of the spermiducal pore but on the same papilla. There are, however, only three very distinct kinds of glands, as the large glands of the sperm-duct and the large glands of the anterior pore resemble each other so much that they can hardly be distinguished one from the other. The smaller cells of the sperm-duct have oval nuclei. These glands open immediately above the pore, while the larger glands open at the pore but still into the sperm-duct. The small glandular cells of the anterior pore stain darkly and appear to be of a very distinct nature from the others (pl. xv, fig. 6).

Genus **Fridericia** Michaelsen.

Definition. — Setæ straight; each fascicle contains setæ of different sizes, the larger ones situated outside of the smaller ones. Head-pore small, between prostomium and somite I. Large dorsal pores in the center of each somite, beginning with VII. Two kinds of lymphocytes. Peptonephridia present. Esophagus gradually merging into the intestine. Dorsal vessel rising posterior to clitellum. Blood colorless. Spermatheca generally with globular diverticles at the base of the ampulla. Sperm-ducts comparatively narrow and long. Penial bulb without interior muscular strands (*Lumbricillus* bulb). Nephridia with large anteseptal. Brain posteriorly and anteriorly convex. The intestine in the vicinity of clitellum contains specialized chylus cells.

DETAILED DESCRIPTION.

Chylus cells.—The most interesting feature in the anatomy of *Fridericia* is undoubtedly the presence of chylus cells. These were first discovered and described by Michaelsen ('86). Michaelsen states that he could not find that the ducts passed from one cell to another. He further states that the cell walls were always indistinct and could not be made out. Even in my own sections I find that the cell walls are generally not very distinct, still I have succeeded in most instances in making them out. I have also, satisfactorily to myself, demonstrated that the canals are indeed entirely confined to a single cell. They never pass from one cell to another. The chylus cells occupy constant somites in the same species, and good species characters may be had from their location, form and size.

The intestine in these somites is lined by a layer of epithelial cells, which are of different size and form in the respective species. Between these epithelials open the chylus cells into the intestine. The chylus cells are generally long and narrow, broader at the bottom than at the apex. They are perforated by a single canal which opens at the apex of the cell and from there continues to the base of the cell, then generally bending or even branching out. The nucleus of the cell is generally situated not far from the base of the cell, in an angle of, but outside of, the canal, where it is bent on itself. The canal is somewhat different in different species. In most species the inner surface of the canal is lined only by a thick layer of cytoplasmic granules. But in some species there is a real lining membrane continued from the mouth of the cell to the base. In others this lining membrane can only be traced a little way down. But the most interesting part is that this inner membrane is actually covered with cilia. At first I concluded that these cilia were accidental ones which had been carried into the canal of the cell with the chylus from the intestine, being digested in the cell together with the chylus. But later I satisfied myself that this is not the case. In several instances I could plainly see that the cilia were attached to the inner membrane.

This can only be explained by supposing that the chylus canal is simply an invagination of the ciliated surface of the cell, and that the object of the cilia is to conduct the chylus as close as possible to the blood sinus at the base of the chylus cell. By means of the canal a much greater surface is exposed to the action of the intestinal juices, and these juices can be quickly and surely brought to a close contact with the blood. In this manner no diminution and weakening of the intestinal wall is necessary, and the same object — that of rapid absorption of the intestinal digested matter — is accomplished with a thick and strongly built intestine. The bottom of the chylus cell rests always on a basement membrane directly in contact with the blood sinus. In order further to increase the contact surface the canal is always bent, and part of it thus runs parallel with the blood sinus. In some species the canal is not only bent, but it is branched and exhibits the form of a bunch of canals, which form must still more facilitate the absorption of the nutritive juice in the intestine. It is probable that these cilia are present in all chylus cells, but it is also certain that they do not extend to the bottom of the canals, but cease a certain distance from the open mouth, generally extending only about half way down the duct. When the canal is bent this bend projects toward the head of the worm, which arrangement would facilitate the driving of the chylus into the canal.

For the various forms of the chylus cells of the respective species I must refer to the description of these species. Here I will only state that the form of the cells is quite varied and characteristic of the species.

The inner lining of the cell is generally bounded on either side by a more or less thick layer of granular cytoplasm. This layer reminds me in many respects of the thick granular layer of the common epithelial cells, which as is well known serves to shut out bacteria and prevents other microbes from entering the cells. This granular layer in the chylus cells probably serves the same purpose, though it may besides have other properties, as for instance, those of a digestive nature. In many species there is no distinct membrane lining the bottom or lower part of the canal, and the granular layer seems to line the lumen. But in some species there is a distinct lining which could not readily be explained except by the theory of invagination. Where the lining is not present we may suppose that an absorption has taken place in that part of the canal. Most of the chylus cells, as first observed by Michaelsen ('86), lean slightly toward the head of the worm in order to facilitate the absorption of the chylus. On this account a good view of these cells can only be had in longitudinal sections. In transverse sections only part of each cell is cut and exposed, and the nature of the structure cannot be made out.

Penial bulb.— The penial bulb of *Fridericia* is quite characteristic and seems to be of similar structure in all the species investigated by the author. There is only one kind of cells filling the bulb. These cells all open in the extension of the sperm-duct and along the surface of the bulb; the duct connects with the bulb at the base of the latter and cannot strictly be said to enter the bulb. The bulb in this species is the simplest of any in this group with distinct bulb.

Nephridia.— In all species described here the nephridia are characterized by a large anteseptal, which in size approaches the postseptal part. In not a single instance does the anteseptal consist of only the nephrostome, as, for instance, in the genus *Lumbricillus*.

SYNOPSIS OF SPECIES OF FRIDERICIA DESCRIBED IN THIS PAPER.

I. Spermathecæ without diverticles.

Brain posteriorly truncate or slightly convex, deltoid. Spermathecal stalk more than twice as long as the ampulla. Peptonephridia with only two branches. Sperm-funnels short, almost globular. Chylus cells in XI, XII and XIII. Duct of chylus cells with a spur pointing forward. Duct lined by a membrane. Very large anteseptal.............. 1. *F. harrimani* sp. nov.

Brain posteriorly slightly emarginated. Spermathecal stalk about twice as long as the ampulla which connects with the intestine. Peptonephridia large, conical, with numerous short branches. Chylus cells in X, XI and XII. Duct of chylus with sigmoid, indistinct spur and without a membrane except at its upper end. Anteseptal large .... 2. *F. johnsoni* sp. nov.

Brain almost circular, posteriorly convex. Spermathecal duct less then twice as long as the ampulla which is connected with the intestine. Peptonephridia with many branches starting from a common base-palmate. Chylus cells in XIV, XV and XVI. The duct is digitate at the lower end, without distinct lining membrane except at the top. Nephridia with long and narrow anteseptal.. 3. *F. fuchsi* sp. nov.

Brain ovoid, posteriorly convex. Spermathecal duct about four times as long as the ampulla which is not connected with the intestine. Chylus cells in XIV, XV and XVI, cells very broad and shallow. Chylus duct sigmoid and much twisted, with a distinct membrane all along its course. Large anteseptal. .... 4. *F. sonoræ* sp. nov.

II. Spermathecæ with two diverticles.

Brain circular, posteriorly convex. Diverticles of spermatheca pendent. Chylus cells in XIV, XV and XVI; duct branched, without distinct lining membrane. Nephridial anteseptal thin and comparatively short.
5. *F. santærosæ* sp. nov.

Brain longer than broad, posteriorly convex. Spermathecal diverticles not pendent. Nephridial anteseptal globular and strongly granulated; unusually thick canal .... 6. *F. santæbarbaræ* sp. nov.

Brain longer than broad, posteriorly convex. Spermathecal diverticles narrow, short, and pendent. Nephridial anteseptal large, deltoid, with few coarse granules .... 7. *F. popofiana* sp. nov.

III. Spermathecæ with many diverticles around the ampulla.

Brain ovoid, posteriorly convex. Spermathecal diverticles of unequal size. Chylus cells in XIV, XV and XVI; ducts twisted; lower part without distinct lining membrane. Nephridial anteseptal very large, ovoid, without granulation at the nephropore........................... 8. *F. macgregori* sp. nov.

Brain deltoid, posteriorly convex. Spermathecal diverticles of unequal size. Chylus cells in XIV, XV and XVI with a short spur. Nephridial anteseptal large, contracted at the center .... 9. *F. californica* sp. nov.

FRIDERICIA HARRIMANI sp. nov.

Pl. xx, figs. 3–5; text-figs. 70 and 71.

Definition.—Length 6 mm., width .5 mm. Somites 35 to 40, with deep intersegmental grooves. Prostomium blunt. Setæ: ventrals about 6 in each ventral fascicle and about 5 in the lateral ones anterior to clitellum. The inner setæ much thinner than the outer ones. Dorsal pores normal. Head pore between prostomium and somite I. Clitellum XII and XIII, not prominent. Sexual papillæ small. Septal glands normal. Peptonephridia short, each with at least two branches starting from the base of the gland Brain deltoid, posteriorly broader than anteriorly; posterior margin almost straight; the anterior margin conical. Dorsal vessel rises in XIV. Blood strongly crystallizable. Intestine with numerous and thick chloragogen cells containing large granules. Chylus cells in XI, XII and XIII. Spermatheca with long narrow duct and deltoid pouch opening into the intestine. No diverticles. Sperm-funnels short, cubical, four times as long as funnels. Nephridia with an enormous anteseptal about as large as the postseptal middle lobe. Lymphocytes not known. Color of body white.

Locality. — In decaying timber at Mountain View, California, Prof. E. M. Ehrhorn.

Characteristics. — This interesting species belongs to the group of *Fridericia sonoræ* and *F. fuchsi*, characterized by absence of spermathecal diverticles. From both these species it is distinguished by the unusually large anteseptal of the nephridia.

DETAILED DESCRIPTION.

Brain. — This organ varies somewhat. In the majority of the specimens opened it was distinctly deltoid, being broader posteriorly than anteriorly. One specimen, however, possessed a brain with sides nearly parallel. The posterior margin is more or less truncate, never strongly convex.

Blood. — The blood in all the specimens (fixed with the bichromate acetic) was so highly crystallized that no good and perfect sections could be had. The crystals were unequally distributed, in some places filling the whole vessel, while in other parts none were to be seen. They were so hard that the edge of the section knife would break at once. Similarly crystallized hemoglobin has not been observed in any other Enchytræid. It is always present in *Sparganophilus*, as commented on by both Benham and myself. The crystals in the present species are found in all the vessels, capillaries, dorsals, and ventrals.

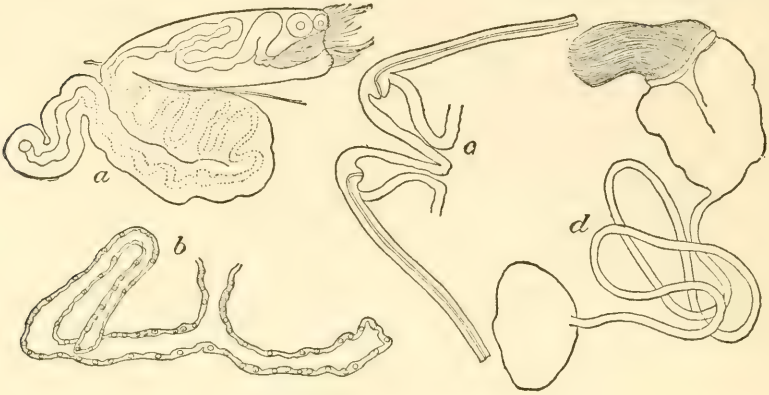


Fig. 70. *Fridericia harrimani.*

Chylus cells. — In several longitudinally sectioned specimens these cells were found in somites XI to XIII. The intestine in these somites is differentiated into a crop consisting of a layer of chylus cells separated in the usual manner by epithelial cells and interstitial cells. The arrangement is a most regular one. Seen in a thin median section passing between the dorsal vessel and the ventral ganglion, and in the longitudinal diameter of the body, we find that the chylus cells are cut through perpendicularly and that each such cell is separated by about two epithelial cells and by one or two interstitial cells. In other words, the chylus cells are placed at regular intervals, the same distance being kept between each two of them in all the three somites. The canal in this species is lined by a distinct membrane which is ciliated along its

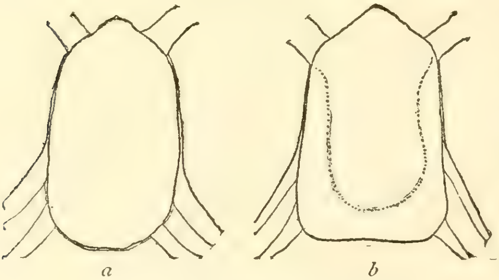


Fig. 71. *Fridericia harrimani.*

upper course near the mouth. The immediate vicinity of the membrane is crowded with granules which stain deeply with eosin, the deeper the nearer the membrane. The lower part of the canal is bent at a right angle to the upper part, and the spur thus formed is in all the cells invariably pointing toward the head of the worm.

Penial bulb. — This organ contains only one kind of cell, though some cells open in the extension of the sperm-duct and others along the free surface of the bulb. The duct enters the bulb near the base. Pl. XX, fig. 4, represents the bulb as seen in a section transverse to the body. In a longitudinal section it would probably appear just as in Pl. XV, fig. 8, representing the bulb of *F. californica.*

Nephridia. — The anteseptal is probably the largest of any observed so far. In some nephridia this part was fully as large as the postseptal lobe. The ciliated part of the nephrostome is quite small. A tortuous, uneven duct runs down from this ciliated chamber to the postseptal.

FRIDERICIA JOHNSONI sp. nov.

Pl. XVI, fig. 6; text-fig. 72.

Definition. — Length 8 mm., width .5 mm. Somites 45 to 48. Prostomium blunt. Dorsal pores begin in VII. Setæ of unequal length, the inner ones much shorter; five and four setæ in the anterior and central fascicles. Head-pore between prostomium and somite I. Clitellum not prominent in XII and XIII. Sexual papillæ small. Anterior septa slightly thicker than those posterior to clitellum. Septal glands in IV, V and VI. Supra-pharyngeal glands small. Peptonephridia thick and compact, with the free end frayed. Brain longer than wide, with the posterior margin slightly concave. The anterior retractor muscles of the brain are situated far forward. Dorsal vessel rises in XIII. Intestine narrow, widening in XIII. Intestine commencing with XIII is covered with a thick layer of very tall chloragogen cells. In the anterior somites these cells are very low and few. Chylus cells in X, XI and XII, none posterior to clitellum. Spermathecæ with a club-shaped apical ampulla connecting with the intestine; no diverticles. Penial bulb with two kinds of glandular cells; those opening at the base of the sperm-duct are the largest. Nephridia with large non-glandular anteseptal in which the duct is spirally wound. The large lymphocytes are disc-like and almost circular. Color white.

Locality. — Garden of Ellwood Cooper, at Ellwood, near Santa Barbara, California, May, 1898. Named for Prof. Herbert P. Johnson, the well-known zoologist, to whom I am indebted for several interesting Oligochæta.

Characteristics. — This species is characterized by its spermathecæ without diverticles and by the position of its chylus cells in somites X, XI and XII. In most other species the chylus cells are found in somites posterior to clitellum.

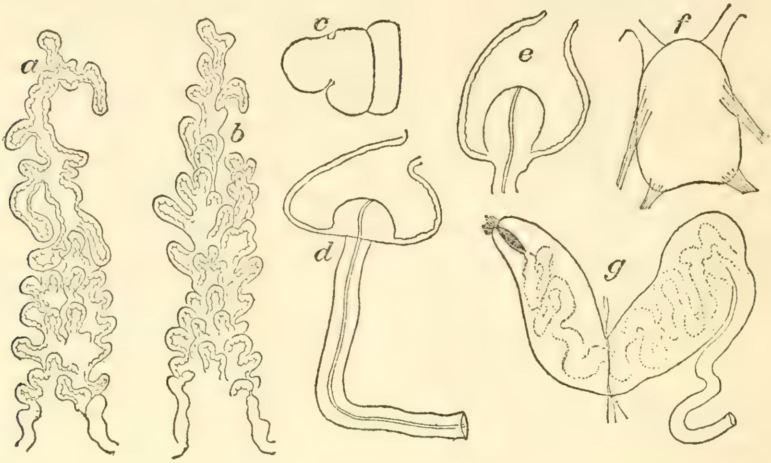


FIG. 72. *Fridericia johnsoni.*

Chylus cells. — The unusual position of these cells has just been mentioned. The cells are long and narrow, with somewhat warty surface. The nucleus is oval, situated below the center of the cell. The chylus cells are separated by rows of single epithelial cells. The latter with round nuclei.

FRIDERICIA FUCHSI sp. nov.

Pl. XVII, figs. 1–3; text-figs. 73 and 74.

Definition. — Length 18 mm., width .5 mm. Somites about 65. Setæ slightly curved, more so in the anterior somites than in the posterior ones, in fascicles of four and five, the inner setæ being much shorter. Dorsal pores commence with VII. Head-pore between prostomium and somite I. Prostomium prominent. Sexual papillæ small. Septal glands large, IV to VI. Peptonephridia with from four to six branches projecting from a common base. Brain almost circular, convex posteriorly and anteriorly. Dorsal vessel rises posterior to clitellum. Intestine with a thin layer of chloragogen cells. Chylus cells in XIV to XVI, long and narrow, separated by very

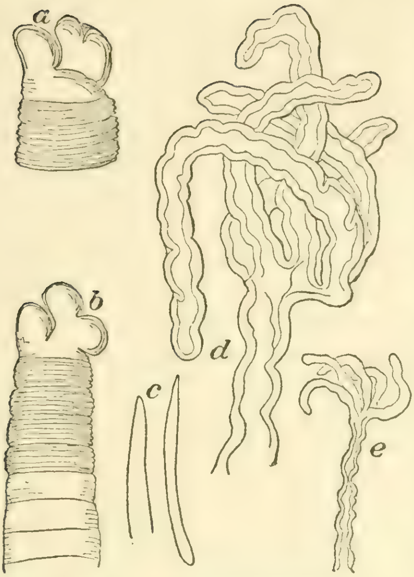


FIG. 73. *Fridericia fuchsi.*

broad and shallow epithelial cells. Spermatheca with a sac-like apical pouch, without diverticles; connects with the intestine, the stem of the spermatheca much twisted. Penial bulb small, with cells opening both into the sperm-duct and at the base of the papilla. Lymphocytes round, disc-like. Nephridia with a long and narrow anteseptal. Color yellowish-white.

Locality.—Santa Cruz Mountains near Boulder Creek, on ranch of Mr. Koester, Prof. Charles Fuchs.

Characteristics.—Exteriorly the species is readily distinguished. The anterior four to six somites are deeply multi-ringed, while all those posterior are perfectly smooth, so smooth that no distinction is seen between the respective somites. The last few somites of the tail are, however, separated by distinct grooves. The nearest related species is *F. sonoræ*, but this latter species has free spermathecæ, while in *F. fuchsi* the spermathecæ open into the intestine.

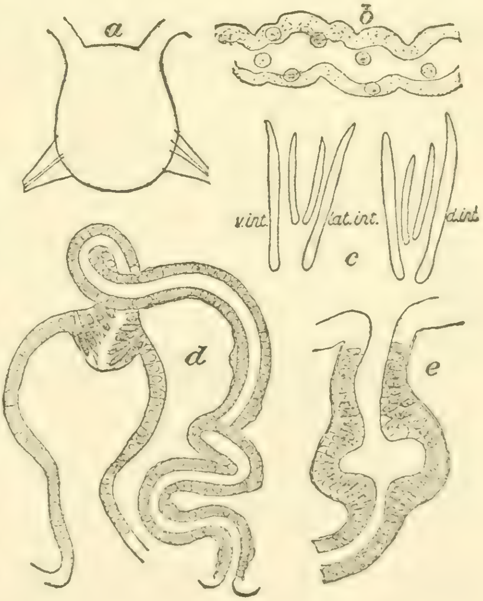


FIG. 74. *Fridericia fuchsi.*

Chylus cells (pl. XVII, fig. 2).—These cells, which occur in three somites posterior to clitellum, are long and narrow. The inner duct is digitate at the base. The chylus cells are separated by epithelial cells which greatly resemble those of *F. sonoræ.* Below the epithelial cells are seen broad interstitial cells with large meshes of cytoplasm. It is to be noted that *F. fuchsi* and *F. sonoræ* also resemble each other in the form of the spermathecæ and in the absence of spermathecal diverticles. These two species differ from all others so far examined by me, by the long and flat epithelial cells of the intestine. In *F. sonoræ* the chylus cells are not as high.

Muscular layer.—The outer muscular layer of the body-wall is quite characteristic. It rises at certain short intervals into the epithelium, almost completely separating these cells. In cross-section these strands are triangular, with the apex pointing toward the cuticle.

FRIDERICIA SONORÆ sp. nov.

Pl. XVI, figs. 1–3; text-fig. 75.

Definition.—Length 12 mm., width .5 mm. Somites about 40. Setæ in bunches, anteriorly of 6, posteriorly of 5, 4 and 3. The outer ones are much larger than the inner ones. Prostomium small and pointed. Clitellum XII and XIII. Sexual papillæ small. Brain ovoid. Dorsal vessel rises posterior to clitellum. Intestine with chylus cells in the two or three somites next posterior to clitellum. Spermathecæ with a large globular ampulla which does not connect with the intestine. Penial bulb small, with a single row of glands opening into the lower part of the sperm-duct, which latter is not dilated. Lymphocytes of two kinds, the large ones small, oval, of a diameter equaling that of two or three muscular strands. The microcytes are from one diameter to half the diameter of a muscular strand. Color pale yellowish-white without pigment. Nephridia with a very large anteseptal.

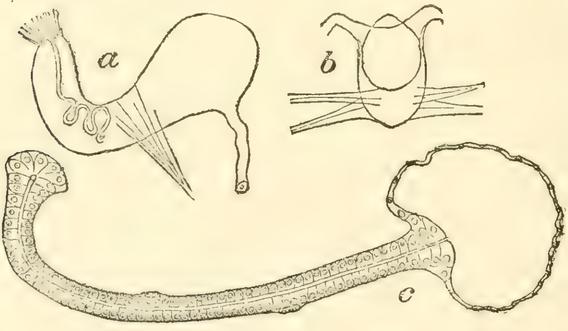


Fig. 75. *Fridericia sonoræ.*

Locality.—San Miguel de Horcasitas, Sonora, Mexico, in soft banks of irrigation ditches, May, 1893. Four small specimens, all containing sand, causing the loss of many sections. The salivary glands, which appear to be simple, could not be made out distinctly enough to be described.

DETAILED DESCRIPTION.

Spermathecæ are small and closely pressed to the body-wall. They do not connect with the intestine. There are no diverticles. The ampulla is thin-walled, with a single row of cells.

Penial bulb is small and contains about one tier of cells. The sperm-duct enters on the lateral side of the bulb, next to the lateral body-wall.

Chylus cells. — The intestine next posterior to the clitellum contains a continuous row of chylus cells containing chylus ducts. The cells containing the ducts are very large and with a large nucleus. The part of the cell opening into the intestinal cavity is drawn out like the neck of a bottle. The ducts are different from those of any other species. Each duct is surrounded by a thick wall, outside of which is a thick body of granular cytoplasm. The duct twists around in the cell but does not connect with ducts of other cells. These chylus cells do not directly line the intestine but are overlapped by an inner epithelial layer of cells which are strongly ciliated and between which the necks of the chylus cells open in the intestine.

FRIDERICIA SANTÆROSÆ sp. nov.

Pl. XVI, figs. 4 and 5; text-fig. 76.

Definition.— Length 14 to 20 mm., width .75 mm. Somites about 60 to 64. Setæ of unequal length, the interior ones much smaller. Prostomium small, but pointed and prominent. Clitellum not prominent, XII and XIII. Male papillæ small, cube-shaped. Peptonephridia with four to six narrow tubules from a thick, elongated base. Brain posteriorly rounded, or with a very slight emargination. Dorsal vessel rises in XV. Intestine and dorsal vessel covered with a thick layer of tall chloragogen glands. Chylus cells in XIV, XV and XVI. Spermathecæ with two diverticles each, and with long cylindrical duct; distal part connected with the intestine. Sperm-funnels longer than broad, with a lobate base. Penial bulb small, containing a single row of glandular cells opening along the base of the bulb. Nephridia with a long narrow postseptal and a shorter narrow anteseptal. Lymphocytes large, elliptical. Color of alcoholic specimens yellowish. No pigment.

Locality.— Santa Rosa, Sonoma County, California. Common under oak trees near the city. Many adult specimens in May, 1893.

Chylus cells in the somites posterior to clitellum are long and narrow, and open between larger ciliated epithelial cells.

Setæ are in fascicles of from four to six. The inner ones are shorter. Sometimes there are three setæ in one-half of the fascicle and only two in the other.

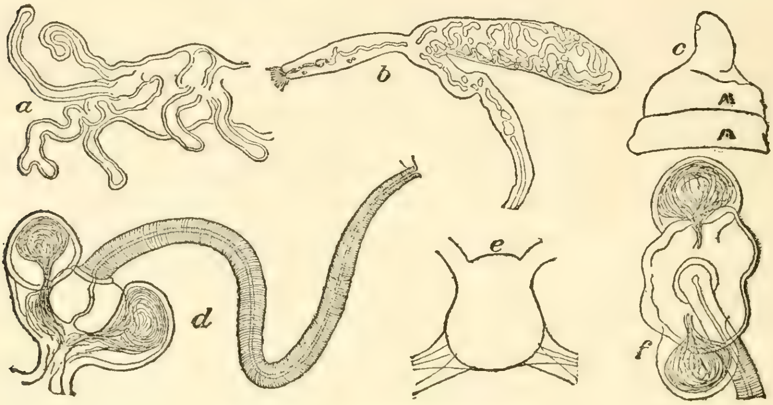


FIG. 76. *Fridericia santærosæ.*

Spermatheca contains as a rule only two large diverticles, but in one specimen I found the large diverticle of one side replaced by three smaller ones.

FRIDERICIA SANTÆBARBARÆ sp. nov.

Text-fig. 77.

Definition.—Length 10 to 12 mm., width .5 mm. Somites about 55. Setæ of unequal length, 4, 5, and 6 in a fascicle, the inner ones much shorter and narrower. Dorsal pores present. Head-pore between prostomium and somite I. Clitellum XII and XIII. Sexual papillæ small. Peptonephridia with several irregular tubes. Brain from one and a half to two times as long as wide, and posteriorly and anteriorly convex. Intestine with a thin layer of shallow chloragogen cells. Spermathecæ, with two large diverticles, connect with the intestine. The penial bulb with two sets of glands opens respectively into the base of the sperm-duct and along the base of the bulb. No accessory penial glands and no prostate glands. Nephridia large. Anteseptal large and swollen and filled with opaque granules; anteseptal with a winding duct. Lymphocytes of two kinds, the larger kind ellipsoidal, with or without pointed ends. Color white.

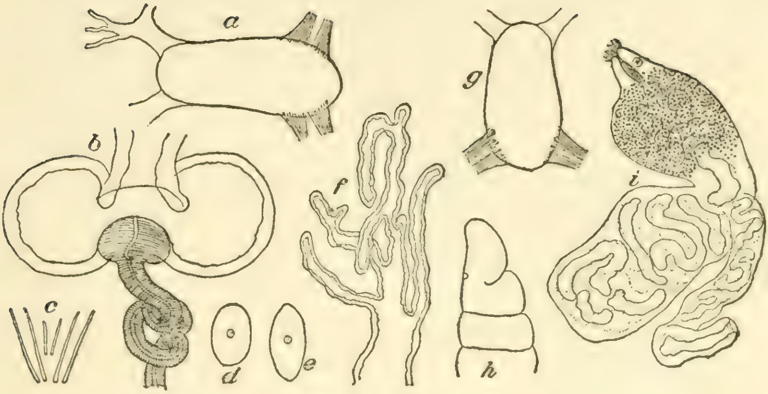


Fig. 77. *Fridericia santæbarbaræ.*

Locality.—Two specimens from Santa Barbara, California, May, 1898. In garden soil. The specimens being in poor state of preservation made it impossible to ascertain the structure of the chylus cells.

FRIDERICIA POPOFIANA sp. nov.

Text-figs. 78 and 79.

Definition.—Length about 18 mm., width .5 mm. Somites over 45. Setæ four in a fascicle, the inner ones smaller. Prostomium blunt, rounded, slightly rugose. Clitellum small, not prominent, XII and XIII. Copulatory papillæ small. Peptonephridia with thick and rather short body, at the apex of which are found four or five branches of smaller lobes. Brain longer than broad, anteriorly straight, posteriorly convex. Spermatheca with a cylindrical thick ampulla which connects with the intestine by a broad opening. The narrow duct is about one-half longer than the pouch, and from one-half to one-third as thick. There are two diverticles at the base of the

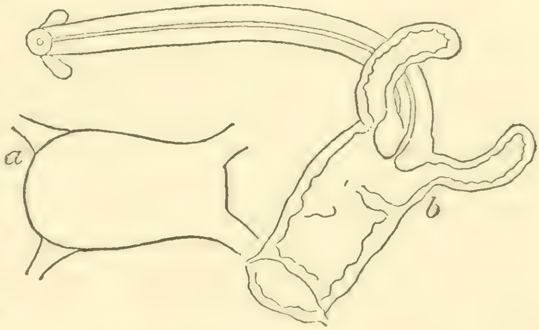


Fig. 78. *Fridericia popofiana.*

pouch. These are about one-half as long as the pouch and slightly wider than the duct. Nephridia oblong with a very long and broad anteseptal, almost equal in size to the postseptal less the duct. The duct leaves the nephridium at the center. Color white, very transparent. Integument thin.

Locality.—Popof Island, Shumagin group, Alaska, Prof. Trevor Kincaid. A single specimen. Several of the posterior somites missing. No attempt at sectioning was made.

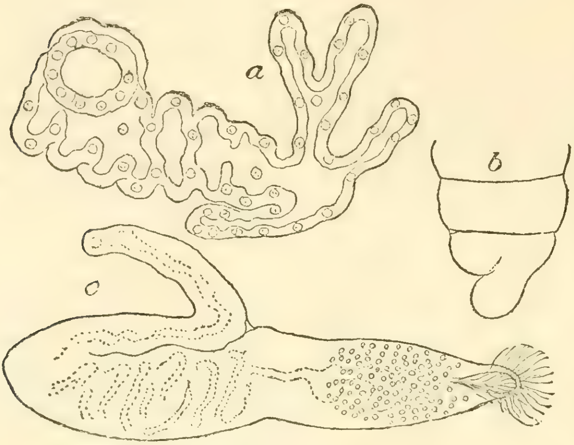


FIG. 79. *Fridericia popofiana.*

Characteristics.—The spermathecæ are the most characteristic parts and must suffice to distinguish the species until more material will allow of sectioning and show the nature of the chylus cells, now unknown.

FRIDERICIA MACGREGORI sp. nov.

Pl. XVII, figs. 4, 5; text-fig. 80.

Definition.—Length about 8 mm., width .5 mm. Somites about 45. Setæ in fascicles: laterals, 4, 4, 5, 5, 0, 6, 7, 6, 5, 4; ventrals, 5, 6, 7, 7, 0, 7, 8, 7, 6, 5, 5, 4. The largest setæ in each bundle are found bordering the dorsal and ventral intervals. Head-pore between prostomium and somite I. Prostomium slightly pointed. Clitellum not prominent. Sexual papillæ small. Septal glands large, in IV, V, and VI. Peptonephridia with six or seven simple branches projecting from a common base. Brain anteriorly much convex, posteriorly slightly so. Dorsal vessel rises in XV. Intestine with large chloragogen cells; in XIV to XVI furnished with numerous long and narrow chylus cells. Spermathecæ with a long tapering muscular duct, and a globular ampulla furnished with about eight diverticles, two of the latter being larger than the others; opens into the intestine. Sperm-ducts narrow, closely wound and confined to the clitellum.

Two sets of glands in the penial bulb. Nephridia with large anteseptal, not strongly granulated. Lymphocytes large, ovoid Color pale, transparent white.

Locality. — In rotten logs at Saint Helena, Napa County, California. Collected by Dr. Richard C. McGregor in 1899.

Characteristics. — The most characteristic feature is the arrangement of the setæ. These are large, and those facing the ventral and dorsal intervals are markedly larger than the others. The spermathecæ resemble those of *F. californica*, but the proportion of stem to ampulla is different; the shape of the stem is also different in the two species.

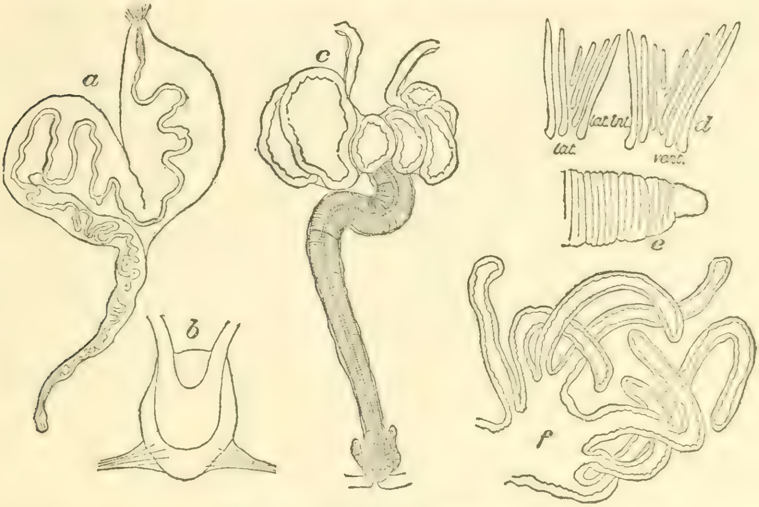


FIG. 80. *Fridericia macgregori.*

From *F. californica* our present species also differs in the form of the nephridia and in the shape of the salivary glands.

The *chylus cells* in the intestine are long, narrow, and are characterized by the lower part of the inner duct being spirally twisted or at least strongly sigmoid. The duct is lined with a regular and even layer of thin cytoplasm, exterior to which is a thicker layer of denser cytoplasm, capable of very dense staining.

FRIDERICIA CALIFORNICA sp. nov.

Pl. XV, figs. 8, 9; text-fig. 81.

Definition. — Length 22 mm., width .5 mm. Somites 70. Setæ anteriorly 5 and 6 in each bundle, posteriorly 6 and 4 of three different sizes. Head-pore large, between prostomium and somite I. Prostomium short, rounded. Clitellum not prominent, XII and XIII. Sexual papillæ small. Septal glands large, in IV to VI. Peptonephridia open in IV, end in V, narrow, slightly and irregularly branched. Brain anteriorly and posteriorly convex, ovoid. Dorsal vessel rises in XVI. Intestine narrow and tubular, changing into sacculated intestine in XIV. Spermathecæ with a row of six or seven bladder-like diverticles around the ampulla; two small accessory glands at the base of the muscular duct. Sperm-ducts long, narrow, with a small penial bulb, in which is found a set of small glands. No other penial glands. Sperm-funnels cylindrical, straight, about twice as long as broad.

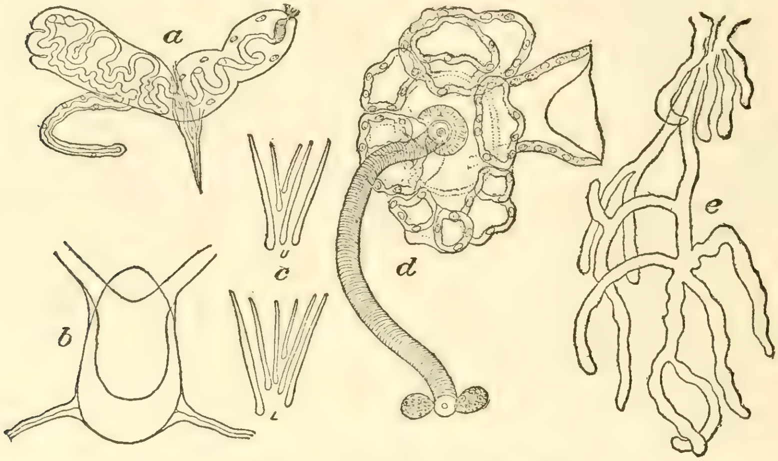


FIG. 81. *Fridericia californica.*

Nephridia with a large anteseptal, frequently contracted at center, and with a straight duct. Lymphocytes of two kinds; the larger cyanophil, the smaller with erythrophil nucleus. Color pale yellowish white.

Locality.—In moist soil around Laguna Puerca, near San Francisco, California.

DETAILED DESCRIPTION.

Spermathecæ.—The diverticles are large and with irregular outlines. Generally one or two diverticles are larger than the others. The duct is even, slightly bent, and somewhat longer than the ampulla. The latter opens into the intestine. The two small glands at the base of the duct are about as wide as the duct.

Penial bulb.—There is only one kind of gland composing the penial bulb. The sperm-ducts enter the bulb near the base, splitting the bulb into two unequal parts.

Ovaries extend as far back as XV and XVI.

The *nephridia* are long and the anteseptal part is nearly equal in length to the postseptal part. The anteseptal is divided transversely into two nearly equal, globular parts. The nephrostome is small. The postseptal part is long and rectangular, with crenate edge. The duct in the anteseptal is spirally wound. Only the part nearest the nephrostome is ciliated.

Lymphocytes. — The larger kind is round, transparent, and its nucleus stains blue. The smaller kind is also round and transparent, but its nucleus stains reddish with eosin-thionin.

Setæ. — The setæ in each bundle are frequently of odd numbers. Thus one bundle may have on one side three setæ and on the other only one, or there may be three on one side and only two on the other. The central setæ are always the smallest. When setæ are wanting on one side it is always the small setæ which are missing.

Chylus cells. — In the three somites next posterior to the clitellum, the intestine possesses numerous chylus cells, separated by common ciliated epithelial cells. These chylus cells are long and comparatively narrow, each containing a single duct. The duct is perpendicular to the base of the cell, except at the very base, where the duct is bent, running parallel with the basal membrane. The duct is surrounded by a thin layer of granular dense cytoplasm. The interior of the duct is ciliated along its upper course.

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ABBREVIATIONS USED IN TEXT FIGURES.

The following abbreviations are used in connection with the text illustrations :

ac. gl., accessory glands opening exterior to the penial bulb near the spermiducal pore.

atr., atrium of the sperm-duct.

at. gl., atrial glands or prostate opening into the atrium of the sperm-duct.

b. w., body-wall or integument.

d. int., dorsal interval, the interval between the dorsal fascicles of setæ.

gl. c., glandular cells opening into the spermatheca.

gl. ep., glandular epithelium.

int., intestine, or in some instances the place where the spermatheca opens into the intestine.

l. m., longitudinal muscular layer of the body-wall.

lat. int., lateral interval; the interval between the ventral and lateral fascicles of setæ.

or. ac. gl., orifice of the accessory glands opening outside of the penial bulb near the spermiducal pore.

p. blb., penial bulb, the glandular and muscular cushion which surrounds the penial pore, and which projects inward in the cœlomic cavity.

p. gl., penial glands, glands which are situated inside the penial bulb and which generally open on the surface of the body around the penial pore.

pr., prostate or accessory glands opening into atrium of the sperm-duct.

pore, the penial pore, the exterior pore of the sperm-duct. Also pore of spermatheca.

spd., sperm-duct, the duct between the sperm-funnel and the atrium.

spd. p., spermiducal pore; the exterior pore of the sperm-duct.

sp. f., sperm-funnel.

spth., spermatheca.

sps., sperm-sacs capping the testes in *Lumbricillus.*

t., testes.

t. c., tactile cells.

tr. m., transverse muscular layer.

v. int., ventral interval, the interval between the ventral fascicles of setæ.

ABBREVIATIONS USED IN THE PLATES.

ac.gl., accessory glands of the spermiducal apparatus.
at.gl., atrial glands.
atr., atrium.
br., brain.
c.m., circular muscles surrounding the ducts of the atrial glands.
cr.m., circular muscles.
chyl., chylus cells in the intestine.
cutic., cuticle.
d.at.gl., ducts of the atrial glands.
d.v., dorsal vessel.
div., diverticle of spermatheca or intestine.
ducts, ducts of atrial glands.
ep., epithelial cells.
epith., epithelium.
glg., ganglion.
gln., ganglion inclosed in septal glands.
gl.c., glandular cells.
gl.d., ducts of atrial glands.
i.p.gl., intra-penial glands.
int., intestine.
l.ch., lower chamber or penial chamber of the sperm-duct.
m., muscles.
p.blb., penial bulb.
p.gl., penial glands.
p.pap., penial papillæ in *Enchytræus.*
p.ch., penial chamber in the lower part of the sperm-duct.
p.pore, penial pore.
s., septum.
sp.d., sperm-duct.
spth., spermatheca.
spth.p., spermathecal pore.
sp.s., sperm-sacs at the ends of the testes.
sep.gl., septal glands.
t., testes.

Note.—The finer details of all the preparations were studied with Zeiss Apo. 3 mm., Apt. 1 : 40. Ocs. 8 and 12. Sections cut in paraffin and mounted in Thus. Xylol. Staining with eosin in alcohol and methylen blue 'o' or with thionin.

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PLATE I.

Mesenchytræus harrimani sp. nov.

FIG. 1. Cyanophil lymphocyte, with granules surrounded by a narrow zone of eosinophil cytoplasm.

2. Cyanophil lymphocyte of the same nature as the foregoing, but of a broader form.

3. Cyanophil lymphocytes in which eosinophil granules are being formed in the zone surrounding the cyanophil granules.

4. Eosinophil lymphocyte with foamy cytoplasm. In some of these minute chambers eosinophil granules are being formed.

5. Eosinophil lymphocytes in which the formation of granules has progressed farther than in the cell represented in the last figure.

6. Eosinophil lymphocyte in which the eosinophil granules have reached their final size. In this stage the granules are thrown out into the cytoplasm.

Mesenchytræus unalaskæ sp. nov.

7. Eosinophil lymphocyte with foamy cytoplasm and eosinophil granules.

Mesenchytræus grandis sp. nov.

8. Cyanophil lymphocytes with the granules surrounded by a narrow zone of eosinophil secretion.

9, 10. Eosinophil lymphocytes.

Mesenchytræus setchelli sp. nov.

11. Cyanophil lymphocyte.

Mesenchytræus eastwoodi sp. nov.

12. Cyanophil lymphocyte.

Mesenchytræus pedatus sp. nov.

13, 14. Cyanophil lymphocytes.

Mesenchytræus fontinalis sp. nov.

15. Cyanophil lymphocyte.

Mesenchytræus kincaidi sp. nov.

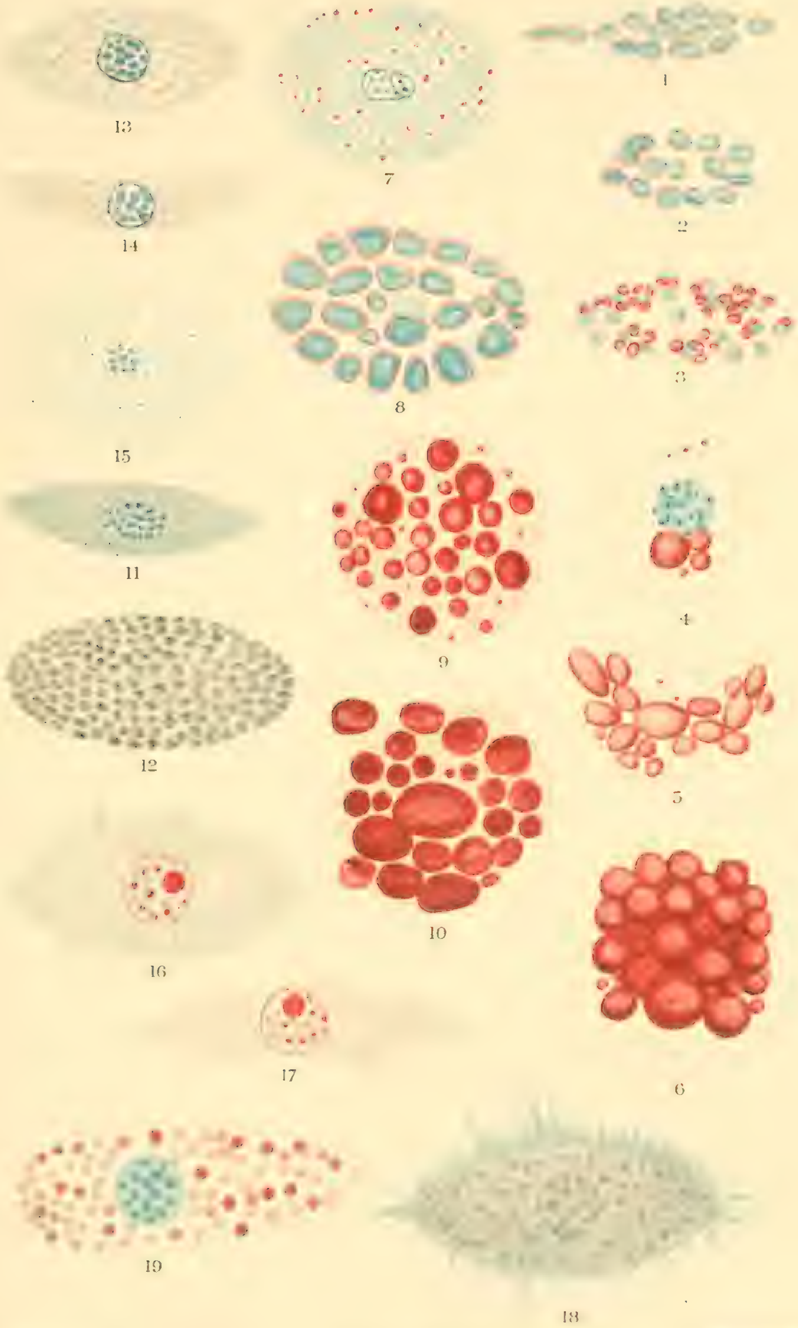
16, 17. Lymphocytes with foamy cytoplasm and without granulations. The margin shows cytoplasmic projections.

Mesenchytræus fuscus inermis subsp. nov.

18. Cyanophil lymphocyte with radiate margin.

Enchytræus alaskæ sp. nov.

19. Eosinophil lymphocyte with numerous globular granulations.



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ENCHYTRÆIDÆ

MESENCHYTRÆUS HARRIMANI	1 TO 6
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MESENCHYTRÆUS EASTWOODI	12
MESENCHYTRÆUS FONTINALIS	15
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MESENCHYTRÆUS KINCAIDI	16, 17
MESENCHYTRÆUS ALASKÆ	19

PLATE II.

Mesenchytræus harrimani sp. nov.

FIG. 1. Section through some epithelial cells lining the inner surface of the sperm-duct at a point marked *xx*, near the opening of the pore.

2. Nephrostome, viewed from the flat or ventral side.

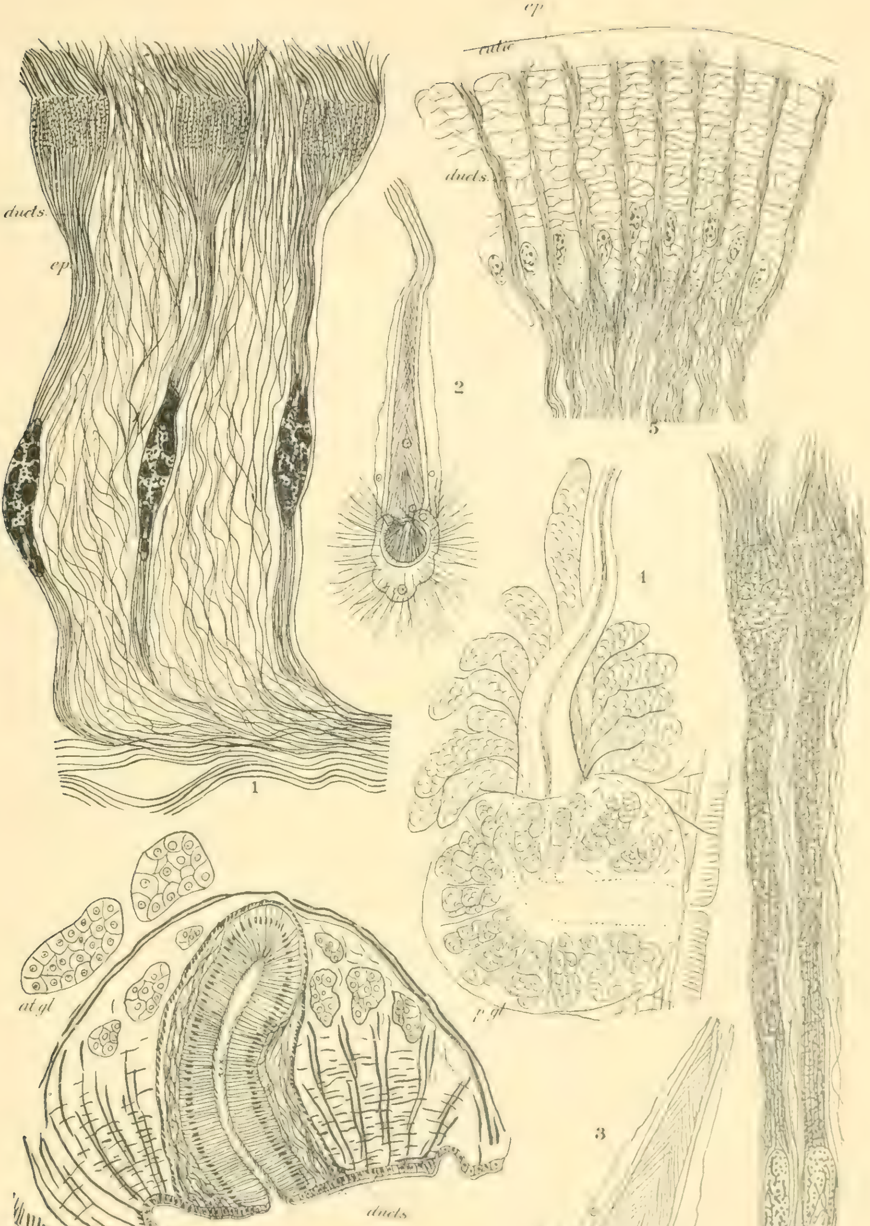
3. Nephrostome, side view.

4. Diagrammatic view of the lower part of the male apparatus, from dissection. The atrial glands are seen to be confined to one side of sperm-duct. The arrangement of the glands in the bulb is merely indicated. The bulb is thick and globular and quite opaque.

5. Section through part of the epithelium near the male-pore from a point marked *x*. The epithelial cells are separated by the narrow ducts of the unicellular glands composing the atrial gland. These ducts open between the epithelial cells. Other ducts open in the lumen of the sperm-duct.

6. Section through the epithelial cells lining the inner surface of the sperm-duct at a point marked *xxx*. The epithelial cells are here thin and long and not situated close together. They are furnished with long cilia. The narrow ducts from the atrial glands are seen to open between the epithelial cells.

7. Section through the male-pore. Low magnification.



ENCHYTRÆIDÆ

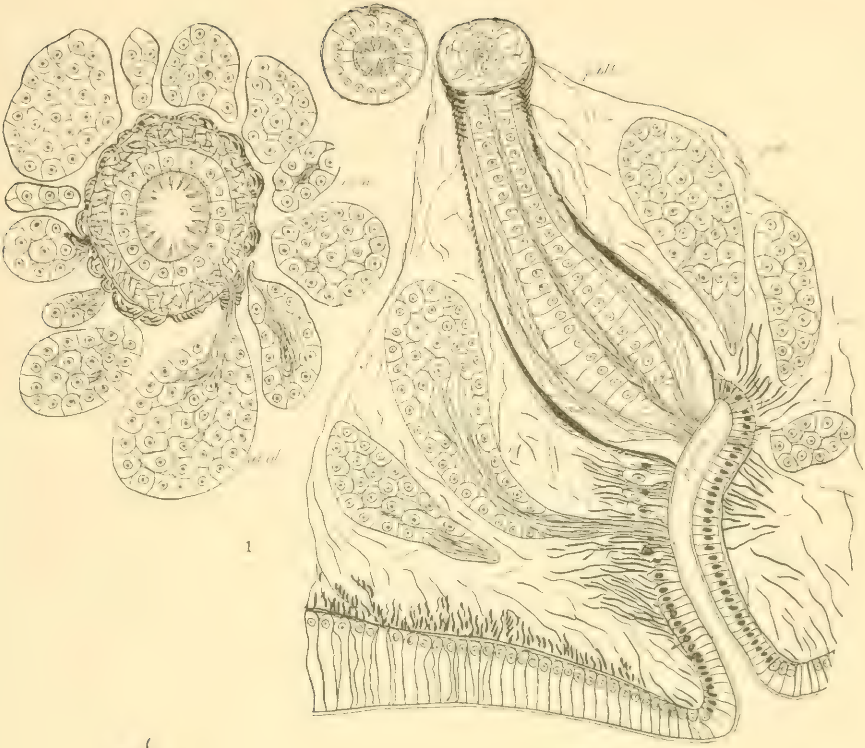
MESENCHYTRÆUS HARRIMANI, 1 TO 7.

PLATE III.

Mesenchytræus vegæ sp. nov.

FIG. 1. The spermathecal apparatus. A part of one of the spermathecæ is not figured. The spermathecæ are connected with the intestine by a narrow duct.

2. A transverse section of the body passing through the penial bulb, atrium, atrial glands, and sperm-duct. One atrial gland is seen to enter the atrium. There are twelve to fourteen ducts of atrial glands leading into the atrium, each duct being surrounded by circular muscles.



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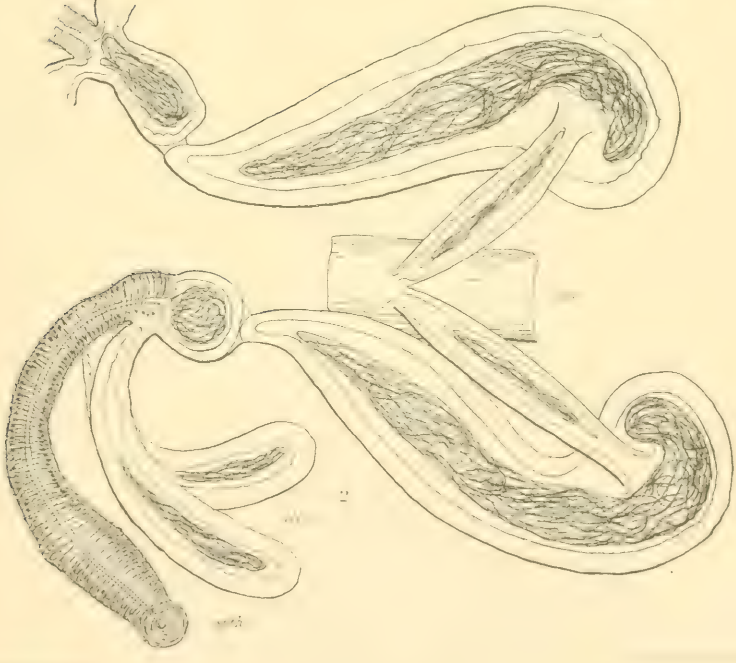

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ENCHYTRÆIDÆ

PLATE IV.

Mesenchytræus setchelli sp. nov.

FIG. 1. Section through the penial bulb and pore, showing the long ducts of the atrial glands opening near the pore. A band of circular muscles surround the atrium inside the penial bulb. This figure is held somewhat diagrammatic.

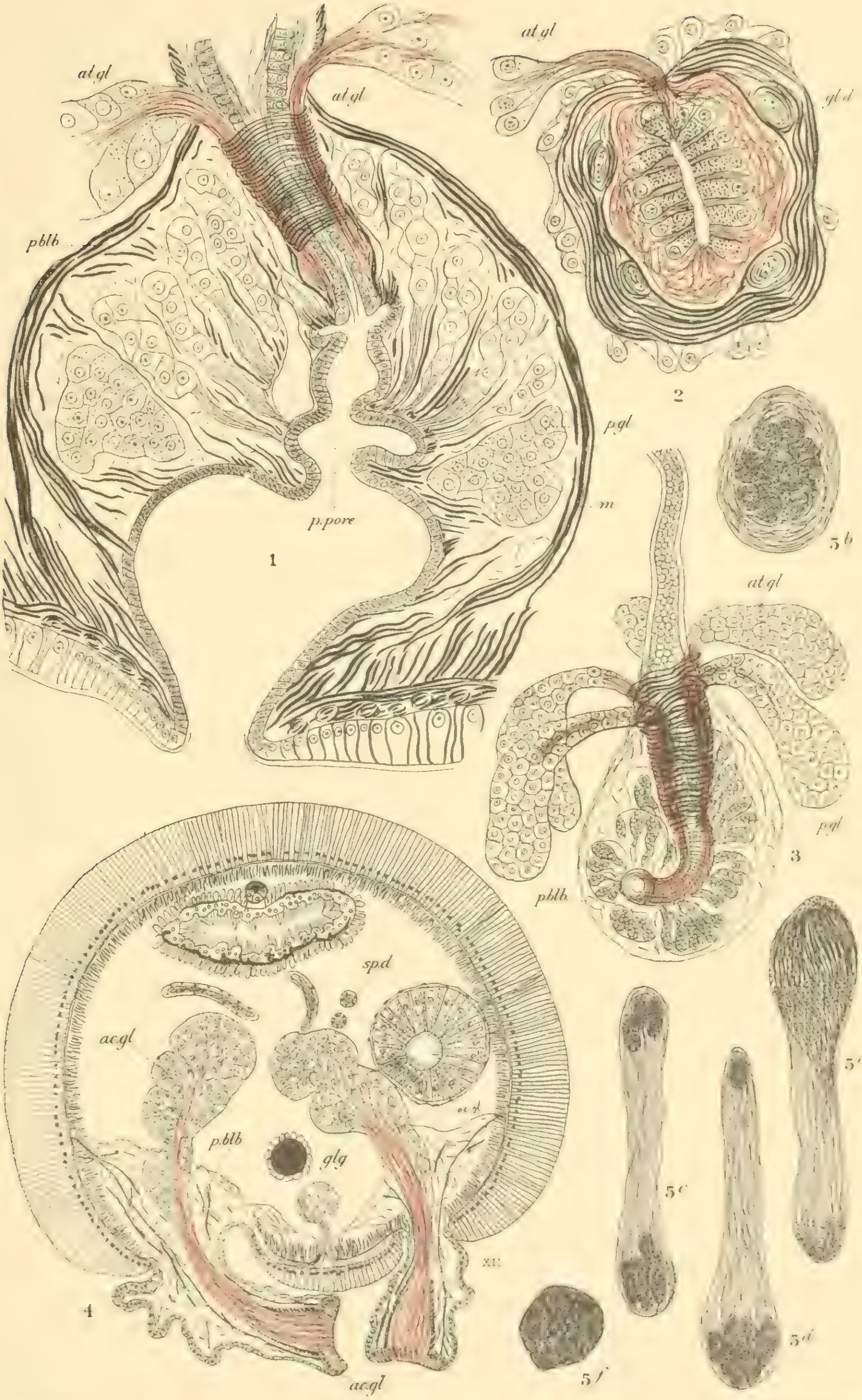
2. Section through the upper part of the atrium, showing the entrance of one atrial gland and the ducts of four other atrial glands.

3. Atrium of sperm-duct with five atrial glands. Somewhat diagrammatic.

Mesenchytræus franciscanus sp. nov.

4. Section through the body in somite XII, passing through the large accessory glands. The pores of the sperm-ducts, and the atrium, etc. are cut by several sections posterior to this one.

5*b*, 5*c*, 5*d*, 5*e* and 5*f*. Spermatophores in various stages of development.



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ENCHYTRÆIDÆ

MESENCHYTRÆUS SETCHELLI, 1. 2. 3.
MESENCHYTRÆUS FRANCISCANUS, 4. 5.

PLATE V.

Mesenchytræus maculatus sp. nov.

FIG. 1. Nephridium.

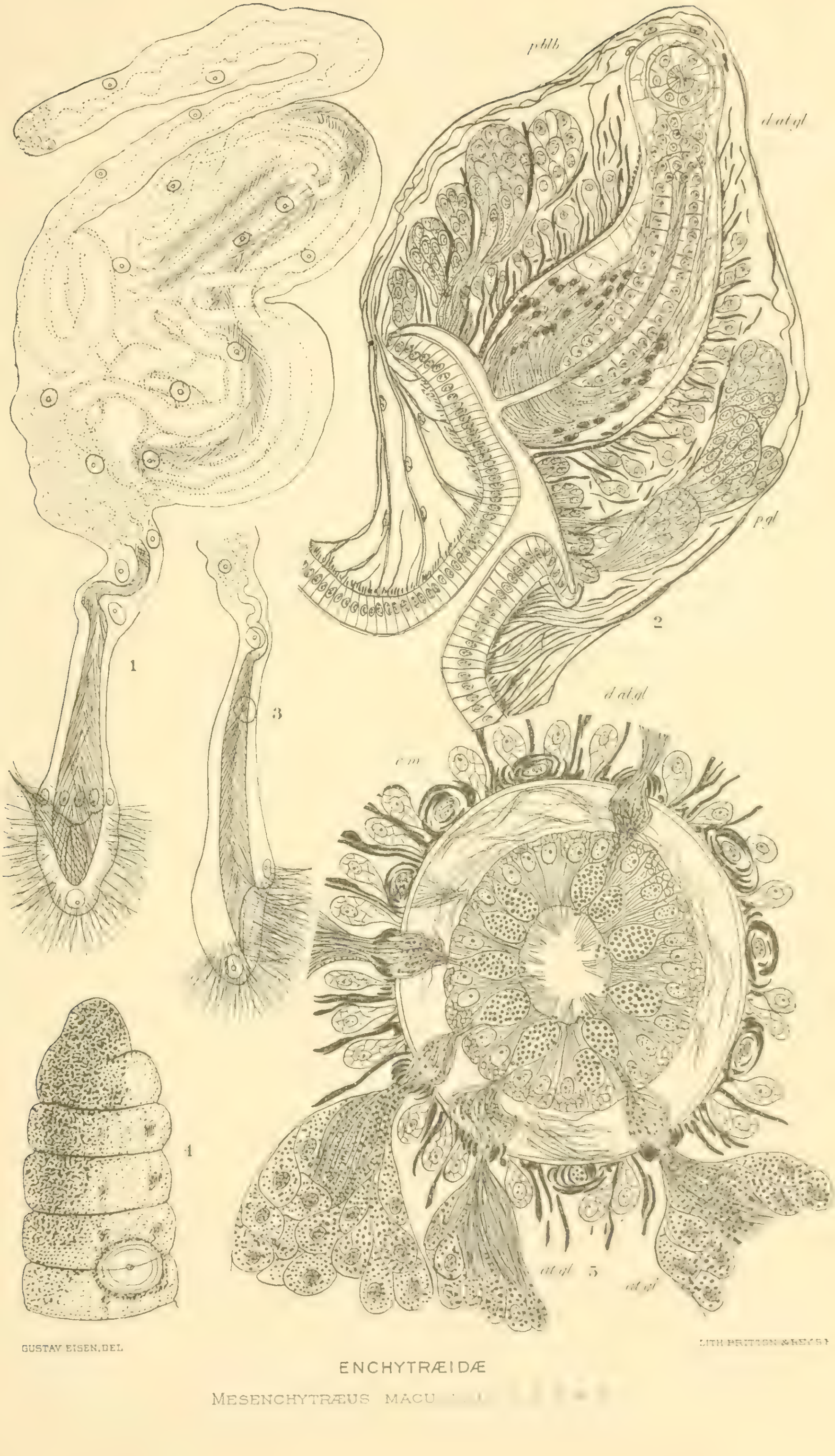
2. Penial bulb and chamber, from a transverse section of the body.

3. Nephrostome, side view.

4. Anterior somites, side view. The large white shield is an unpigmented field surrounding the spermathecal pore.

5 Atrium, just outside of the penial bulb, from a cross-section of the body. Only two of the atrial gland fascicles are partly delineated. Their ducts are seen to open into chambers situated between the epithelial cells. These pockets are filled with eosinophil granulations from the glands.

PLATE V.



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ENCHYTRÆIDÆ

MESENCHYTRÆUS MACU [illegible]

PLATE VI.

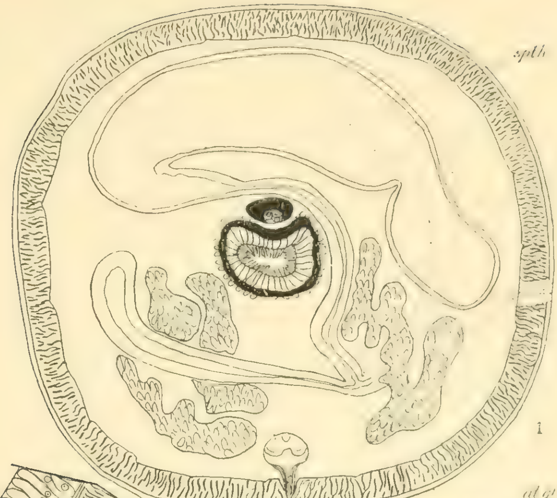
Mesenchytræus obscurus sp. nov.

FIG. 1. Section through the spermathecal somite, illustrating the relative size of the spermathecæ. Section passes through only one of the spermathecæ.

2. Section through the body-wall of the male-pore. *at.gl.*, atrial glands scattered irregularly all around the atrium and opening into its inner chamber; *atr.*, atrium and sperm-ducts; *p.blb.*, penial bulb; *p.gl.*, penial glands inside the penial bulb, opening at the pore; *spd.*, sperm-duct connecting ultimately with the funnel.

Mesenchytræus eastwoodi sp. nov.

3. The male spermiducal apparatus. There are two atrial glands opening into the atrium close to its base and adjoining the penial bulb. *atr.*, atrium; *d. at.gl.*, ducts of atrial glands; *at.gl.*, atrial glands; *p.gl.*, penial glands opening in the penial bulb.



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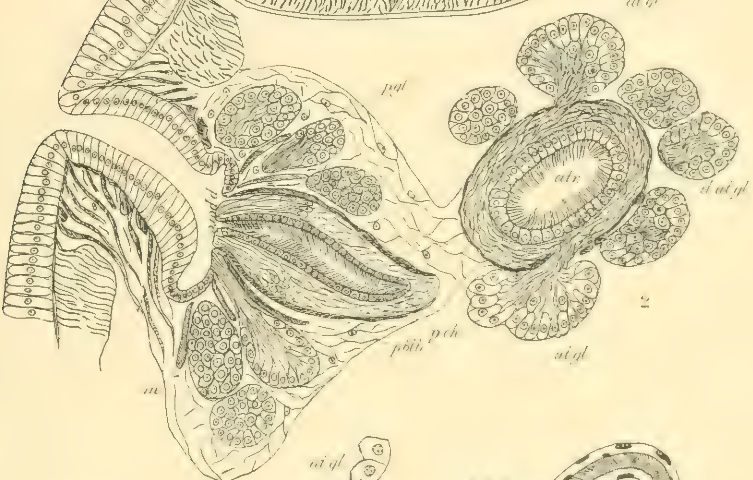

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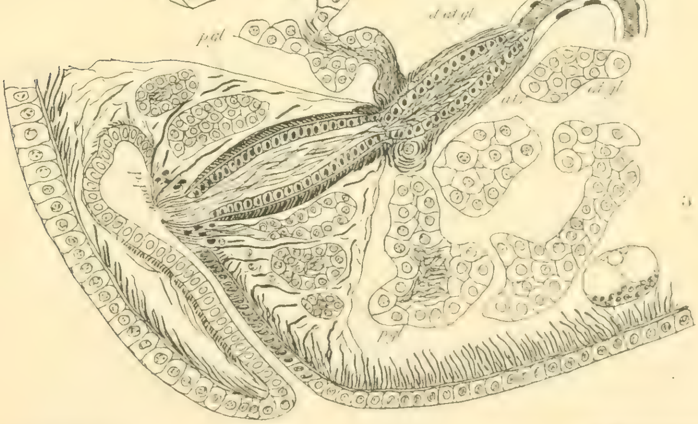

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ENCHYTRÆIDÆ

Mesenchytræus obs [illegible]
Mesenchytræus f [illegible] 3

PLATE VII.

Mesenchytræus grandis sp. nov.

FIG. 1. Section through the sperm-sac. *perit.*, peritoneum; *m.*, muscular layer; *ep.*, epithelium.

2. Section through the lower part of the sperm-duct and the penial bulb. *at.gl.*, prostates opening into the atrium (the ducts of the atrial glands are seen to pass down into the lower part of the sperm-duct); *d.at.gl.*, ducts of the prostates; *pb.*, penial bulb; *p.gl.*, penal glands (all are inside the bulb).

3, 4. Common lymphocytes.

5. Eosinophil lymphocyte.

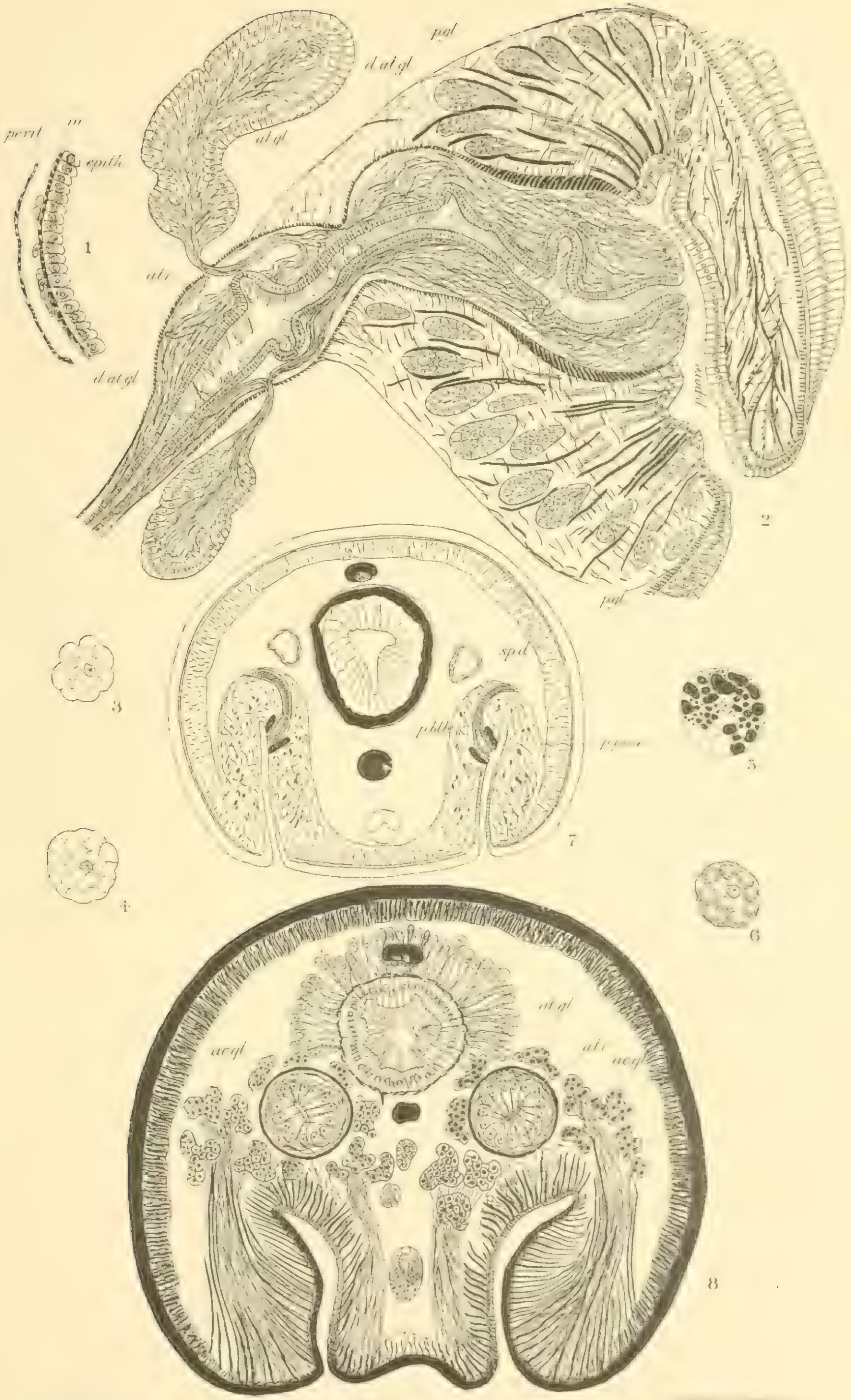
6. Cyanophil lymphocyte.

Mesenchytræus kincaidi sp. nov.

7. Section through the body, somite XII, passing through male-pores. There is only a small penial chamber inside the bulb, but no atrium in the same sense as in some other species of this genus. There are no penial glands inside the bulb, nor are there any atrial glands opening into the sperm-ducts.

Mesenchytræus solifugus Emery.

8. Section through the penial pores and bulbs. *atr.*, atrium of the sperm-ducts; *ac.gl.*, accessory glands opening at the apex of the penial papillæ; these glands do not enter the penial bulb. The black part of this figure represents the body-wall strongly charged with pigment granules.



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ENCHYTRÆIDÆ

MESENCHYTRÆUS GRANDIS.
MESENCHYTRÆUS KINCAIDI
MESENCHYTRÆUS SOLIFUGUS.

PLATE VIII.

Mesenchytræus solifugus Emery.

FIG. 1. Cross-section of the atrium, showing the entrance of three of the atrial glands. *at.gl.*, atrial glands; *cr.m.*, circular muscles surrounding the ducts of the atrial glands at their entrance into the atrium; *d.at.gl.*, ducts of the atrial glands continuing into the atrium; *ep.*, a thick epithelial layer of cells surrounding the muscular part of the atrium. The inner large cells are strongly charged with eosinophilous granules. Similar granules are found in the atrial glands in large quantities.

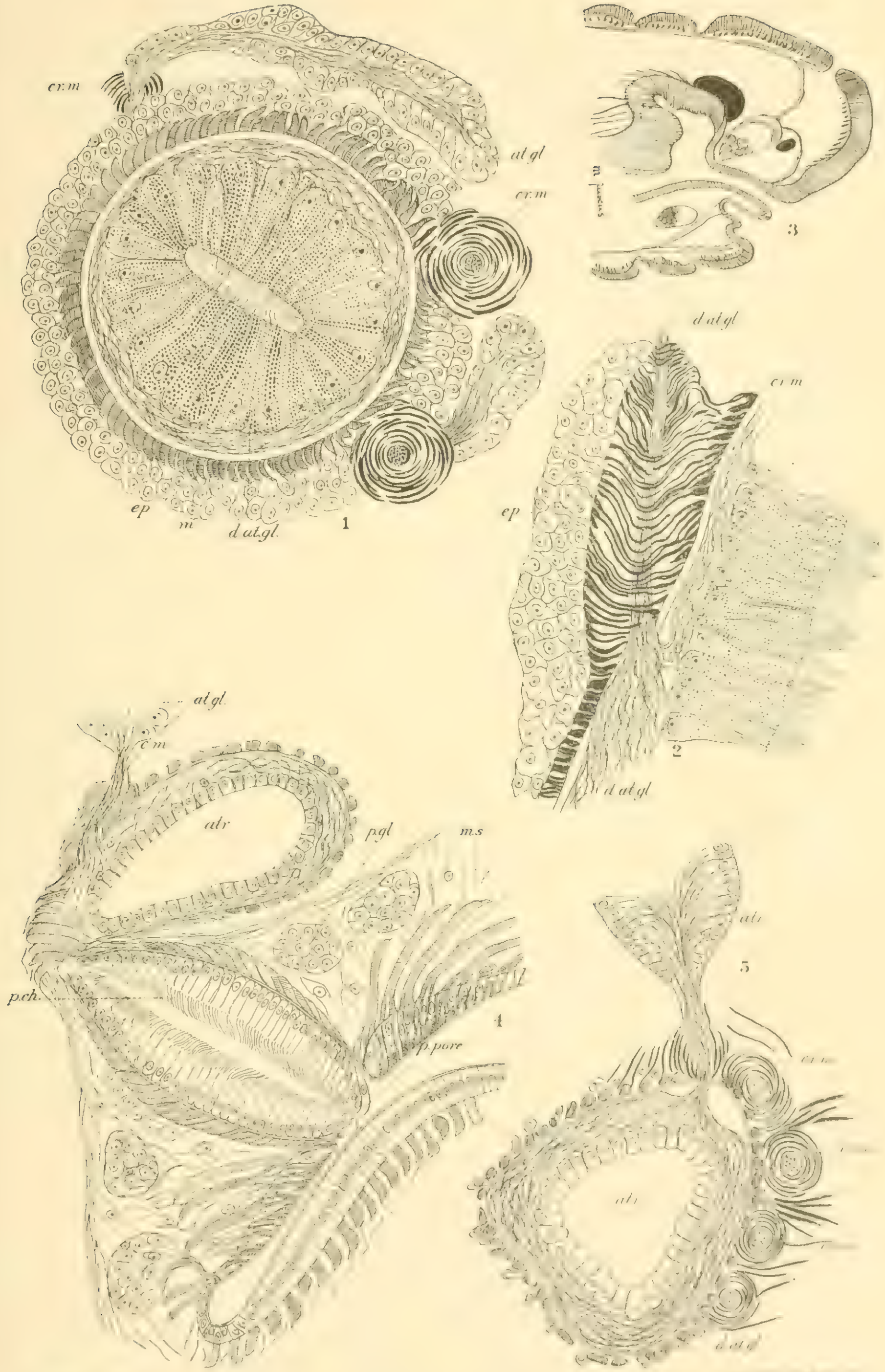
2. A detail of the point of entrance of a prostate in the atrium; longitudinal section.

Mesenchytræus fuscus sp. nov.

3. Anterior somites.

4. Section through the male-pore. *atr.*, atrium; *at.gl.*, atrial gland; *spd.*, sperm-duct; *p.gl.*, penial glands inside the bulb; *m.*, muscles separating the penial glands; *c.m.*, circular muscles surrounding the ducts of the atrial glands.

5. Cross-section of the atrium showing the entrance of one of the atrial glands and circular muscles surrounding the ducts of four other atrial glands. *atr.*, atrium; *at.gl.*, atrial gland; *spd.*, sperm-duct; *p.gl.*, penial glands inside the bulb; *m.*, muscles separating the penial glands; *d.at.gl.*, ducts of the prostate cells. The fine ducts, or prolongations of the unicellular atrial glands, are seen as a mass surrounding the clear glandular epithelium inside the atrium.



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ENCHYTRÆIDÆ

MESENCHYTRÆUS SOLIFUGUS. 1, 2.
MESENCHYTRÆUS FUSCUS. 3, 4, 5.

PLATE IX.

Mesenchytræus penicillus sp. nov.

FIG. 1. Section through the somite containing the male-pore. *pb.*, penial bulb, sagittal section; *at.gl.*, prostates opening through the bulb into the atrium; *atr.*, atrium; *p.gl.*, penial glands inside the bulb; *sp.s.*, sperm-sacs; *os.*, ovisacs.

2. The lower part of the sperm-duct with the four atrial glands opening into the atrium. Letters indicate the same as in fig. 1.

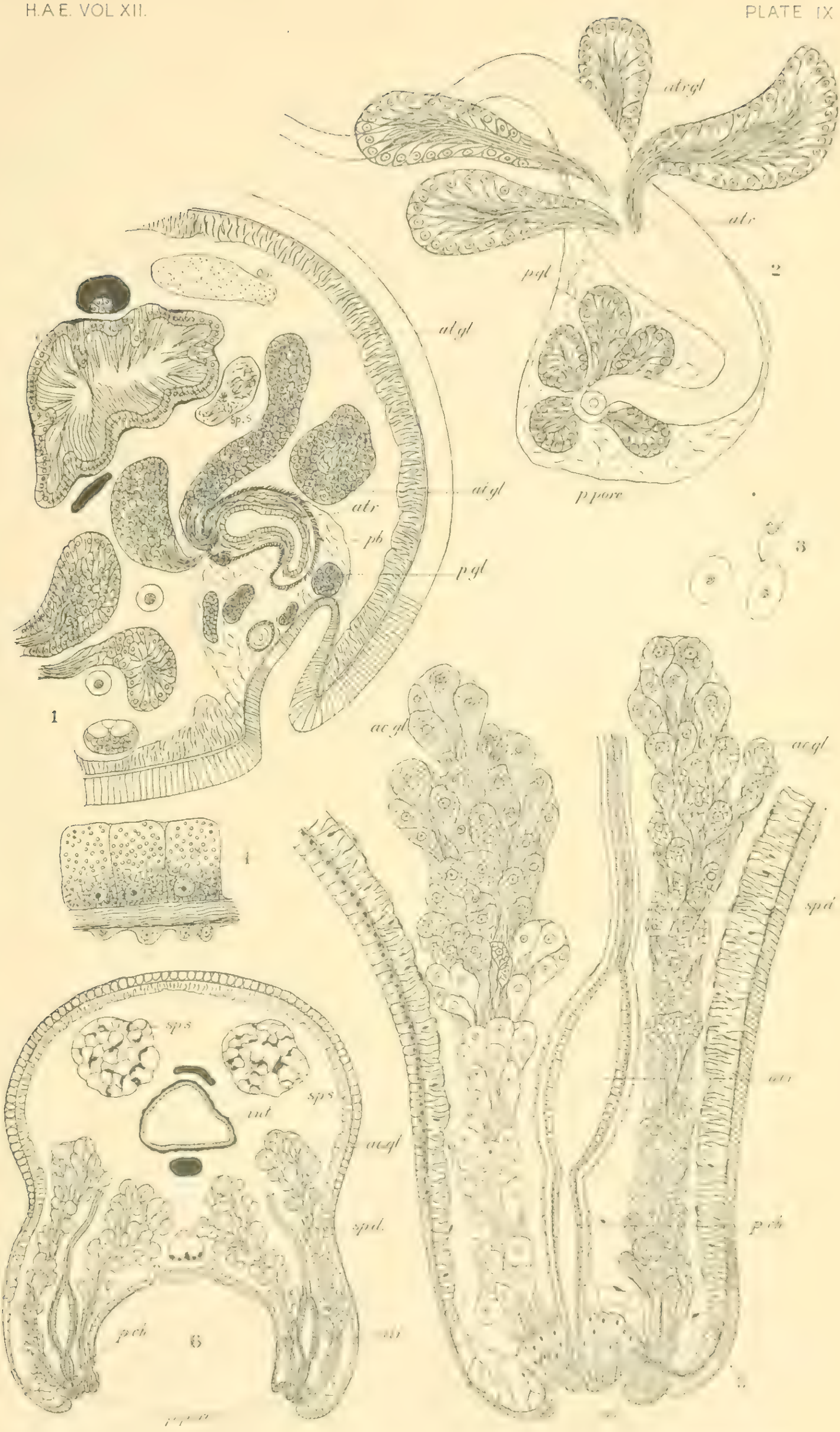
Mesenchytræus pedatus sp. nov.

3. Lymphocytes. These are of very large size and in this respect different from most other species of the genus *Mesenchytræus*.

4. Section through the atrium, showing the inner epithelium, the muscles, and the outer epithelium. There are no prostates in the species.

5. Longitudinal section through somite XII passing through male-pores. *atr.*, atrium; *l.ch.*, lower chamber of the sperm-duct, a secondary atrium; *p.blb.*, penial bulb containing unicellular glands; *ac.gl.*, accessory glands opening at the apex of the penial papilla; *sp.d.*, sperm-ducts; *sp.s.*, sperm-sacs; *int.*, intestine (the dark lines are blood vessels).

6. Cross-section through male-pores more highly magnified than in the last figure.



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MESENCHYTRÆUS PENICILLUS, 1, 2.
MESENCHYTRÆUS PEDATUS, 3, 4, 5, 6.

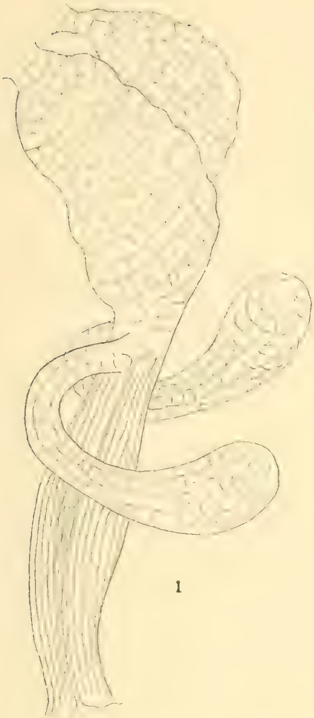
PLATE X.

Mesenchytræus beringensis sp. nov.

FIG. 1. Spermatheca. Side view. One spermatheca is seen entire. Of the other only the junction with the intestine is shown.

2. Transverse section of the body in somite XII, passing through the sperm-ducts and the male-pores. The penial bulb is seen to contain large penial glands, while the absence of accessory and atrial glands is prominently characteristic. *p.ch.*, penial chamber; *f.*, funnels; *p.gl.*, penial glands; *sp.d.*, sperm-ducts.

3. Section passing through the male-pore and papilla; from a transverse section of the body. *p.b.*, penial bulb; *p.ch.*, penial chamber or lower part of sperm-duct; *p.gl.*, penial glands, opening around the pores and entirely confined inside the penial bulb; *atr.*, atrium of the sperm-duct. The penial chamber is enclosed in a sheath of circular muscles. A few intra-penial glands open around the pore.



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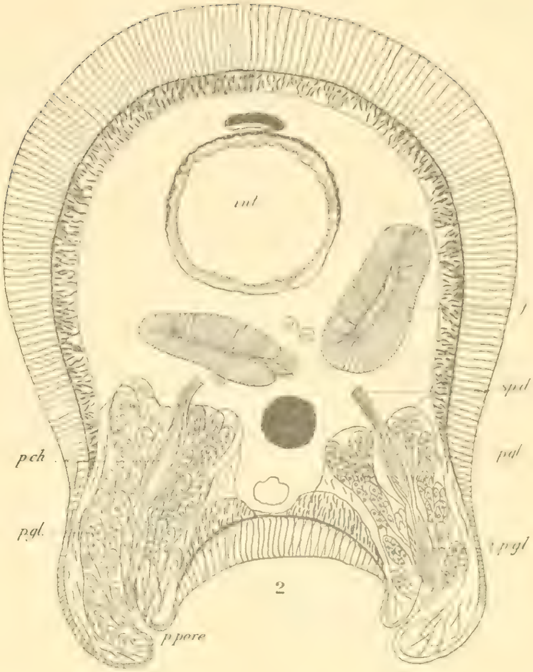

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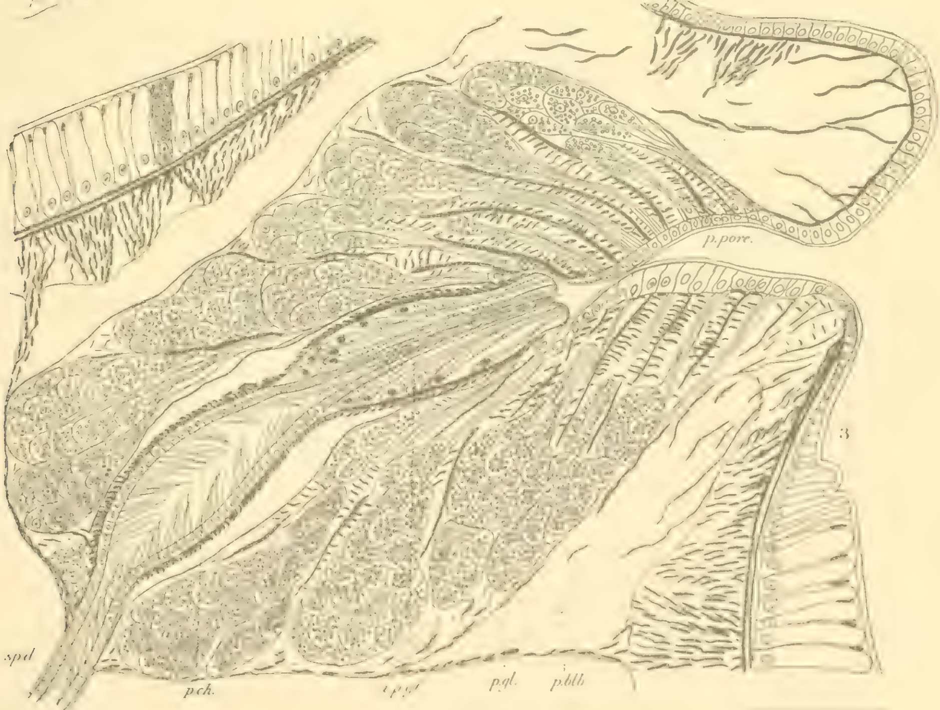

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MESENCHYTRÆUS BERINGENSIS. 1. 2. 3.

PLATE XI.

Mesenchytræus orcæ sp. nov.

FIG. 1. Spermatheca. One of average size; in other specimens the ampulla was considerably larger in proportion to the duct.

2. Section passing through the penial pore. The penial bulb is seen to be unusually small, consisting only of muscle fibers and connective tissue. There are only atrial glands opening into the atrium at or not far from the pore. The atrium is about twice as thick as the sperm-duct. Two sections of the latter are seen in the figure. Only the basal part of the atrium is engaged in the muscles of the penial bulb.

Mesenchytræus fontinalis sp. nov.

3. Part of the spermiducal apparatus; only part of the duct is shown. There are no prostates, only accessory glands opening at the apex of the penial papilla. The funnel is shown to the left. *gl.c.*, glandular cells composing the bulb; *atr.*, atrium; *ac.gl.*, accessory glands opening at apex outside of the bulb.

Mesenchytræus asiaticus sp. nov.

4. Section through the penial bulb and part of the atrium. The atrial glands and their entrance into the atrium are not shown in the figure, but the ducts of the glands are indicated.

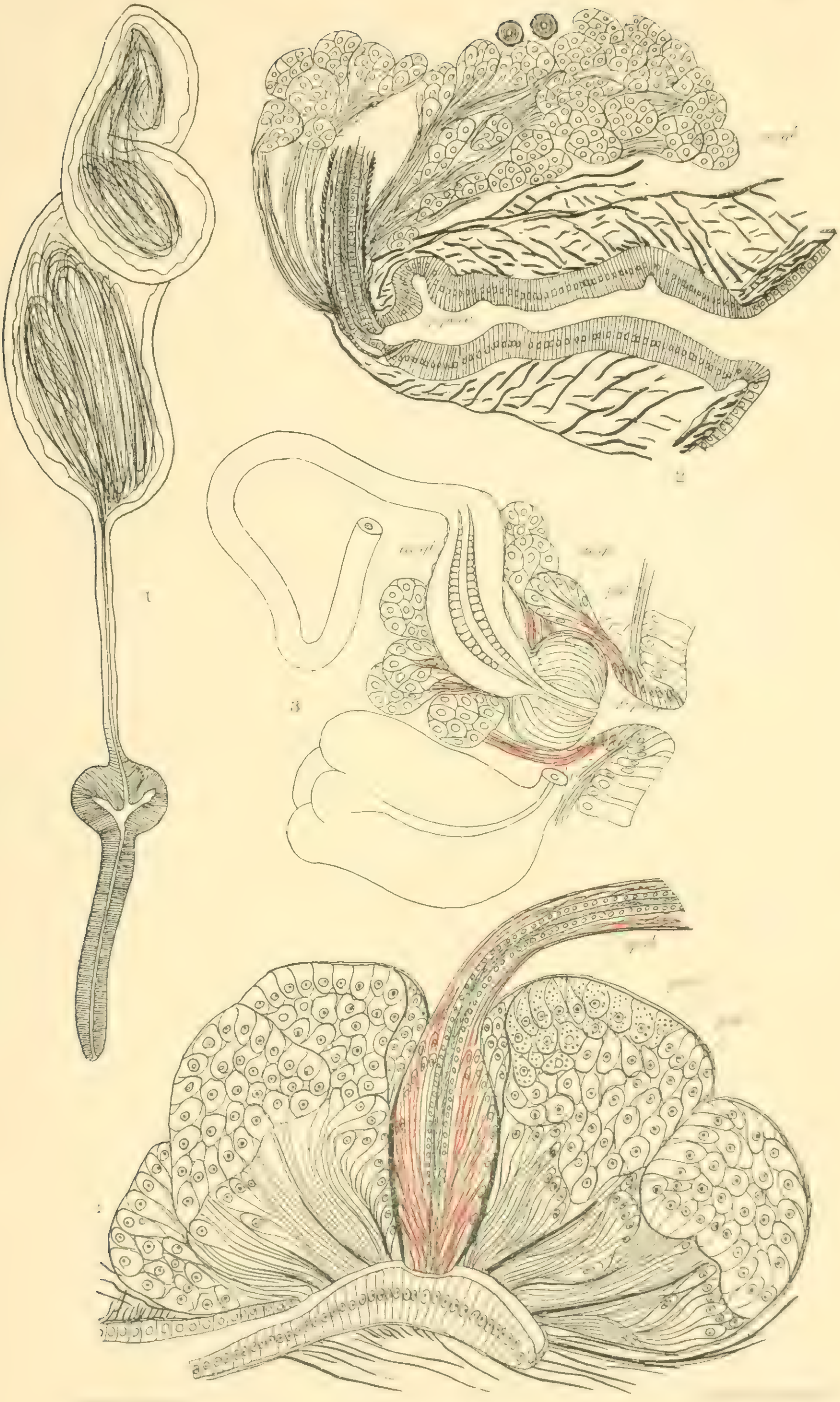

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PLATE XII.

Bryodrilus udei sp. nov.

FIG. 1. Section through the anterior somites. *br.*, brain; *phx.*, pharynx; *gln.*, ganglion enclosed in the anterior septal gland; *sep.gl.*, anterior septal gland; *dv.*, dorsal vessel; *div.*, diverticle of the intestine (there are four of these diverticles, only two appearing in the section).

2. One of the nephridia. The ducts are much ramified.

3. Section through somite v, showing the spermathecæ and their junction with the intestine.

3*a*. A seta.

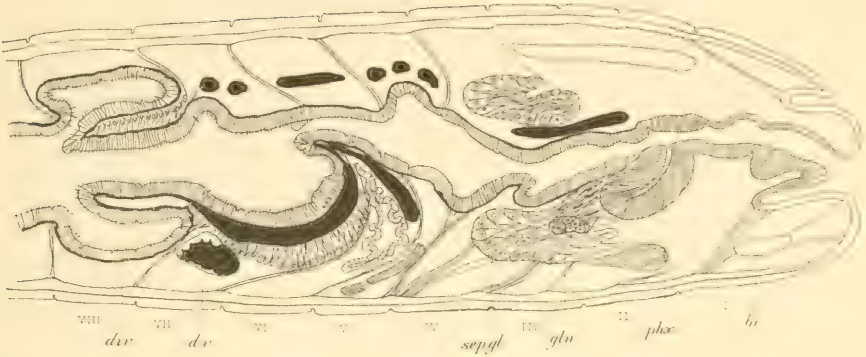
4. Section through the penial bulb. The lower part of the sperm-duct is furnished with small glands opening in the duct. Another set of glands open on the exterior of the bulb.

Lumbricillus merriami sp. nov.

5. Spermatheca.

Lumbricillus merriami elongatus var. nov.

6. Spermatheca.



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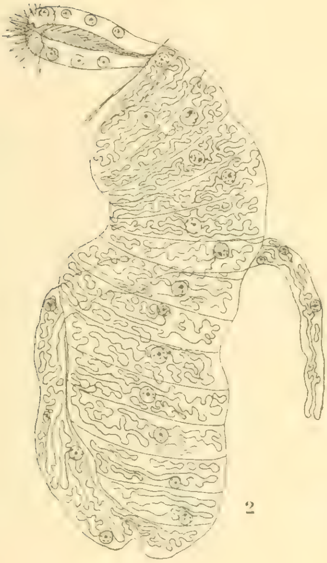

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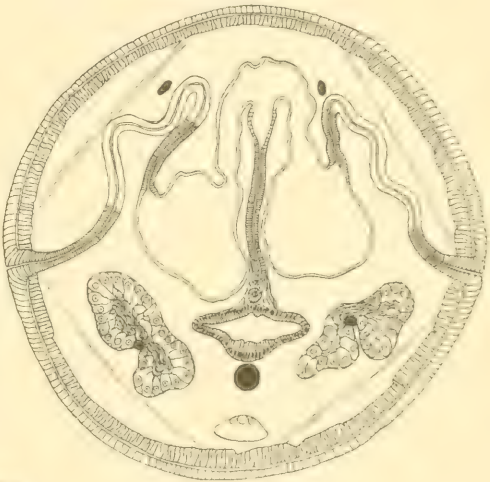

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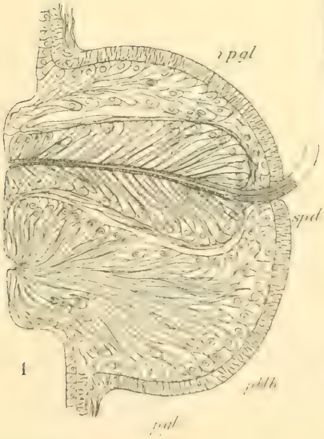

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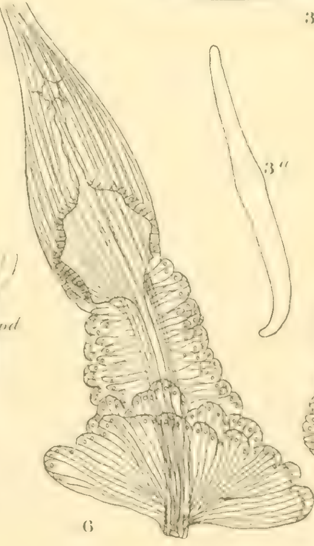

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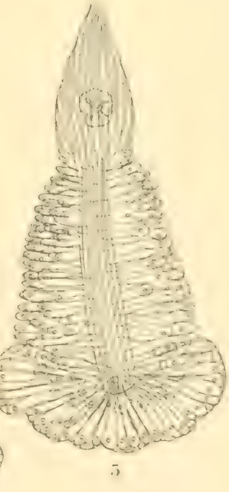

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Bryodrilus udei. 1. 2. 3. 4.
Lumbricillus merriami, 5.
Lumbricillus merriami var elongatus. 6

PLATE XIII.

Lumbricillus franciscanus sp. nov.

FIG. 1. Section through the penial bulb. There are two sets of glands, one set opening into the sperm-ducts, the other on the surface of the bulb.

2. Section of one of the ventral glands.

Lumbricillus santæclaræ sp. nov.

3. Section through penial bulb. At the top is seen the sperm-duct in section; surrounding the lower part of the duct are a set of unicellular glands.

4. Section through one of the ventral glands.

Lumbricillus ritteri sp. nov.

5. Spermatheca. There are two sets of glands, one set around the base, and another along the duct. The apical part connects with the intestine.

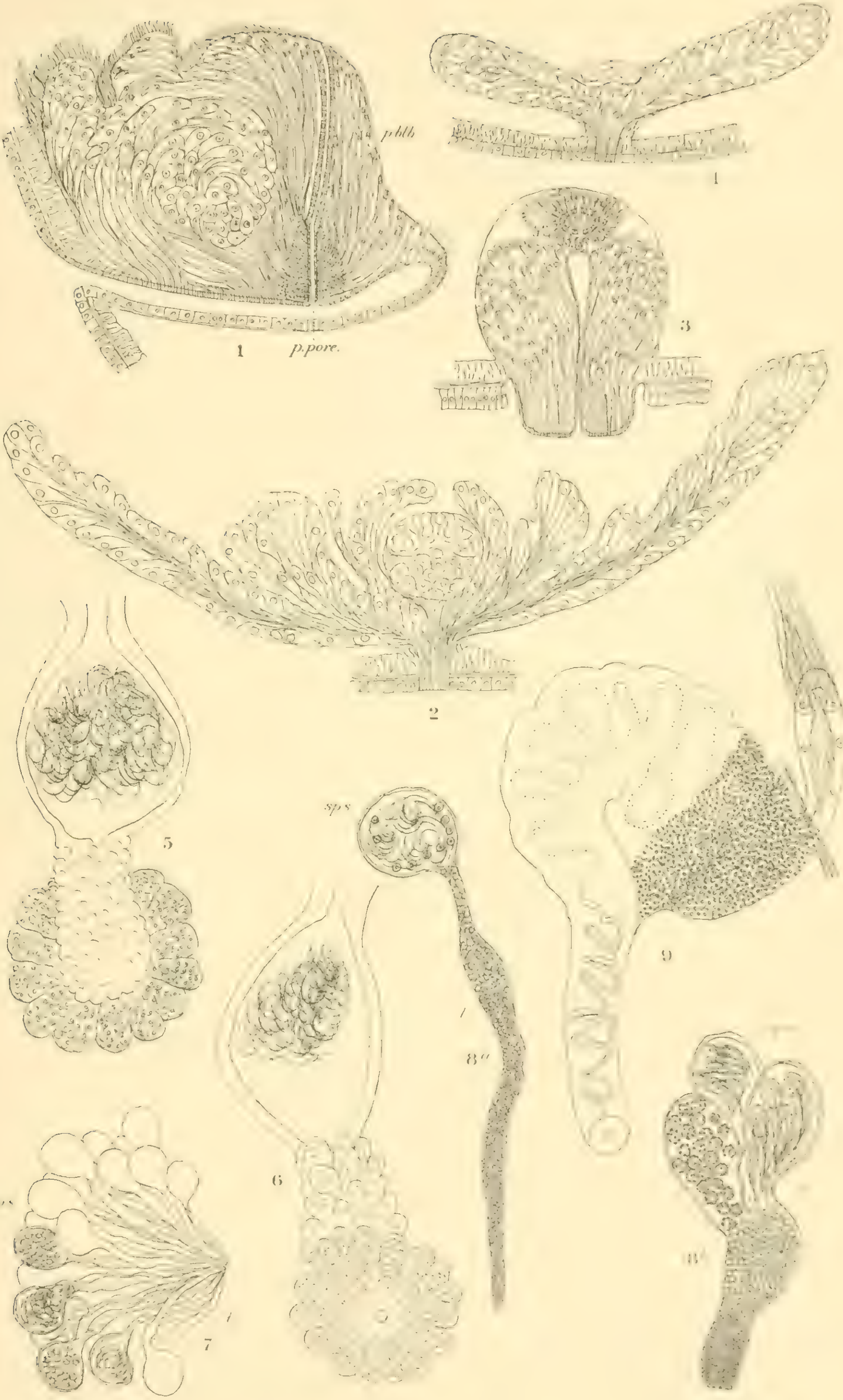
6. Another spermatheca.

7. One of the testes.

8, *a*, *b*. Two lobes of the testis. The apical globular sacs are the sperm-sacs.

9. Nephridium. The neck of the central part is strongly glandular.

PLATE XIII



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LUMBRICILLUS FRANCISCANUS.
LUMBRICILLUS SANTÆCLARÆ. 3.
LUMBRICILLUS RITTERI. 5. 6. 7. 8. 9

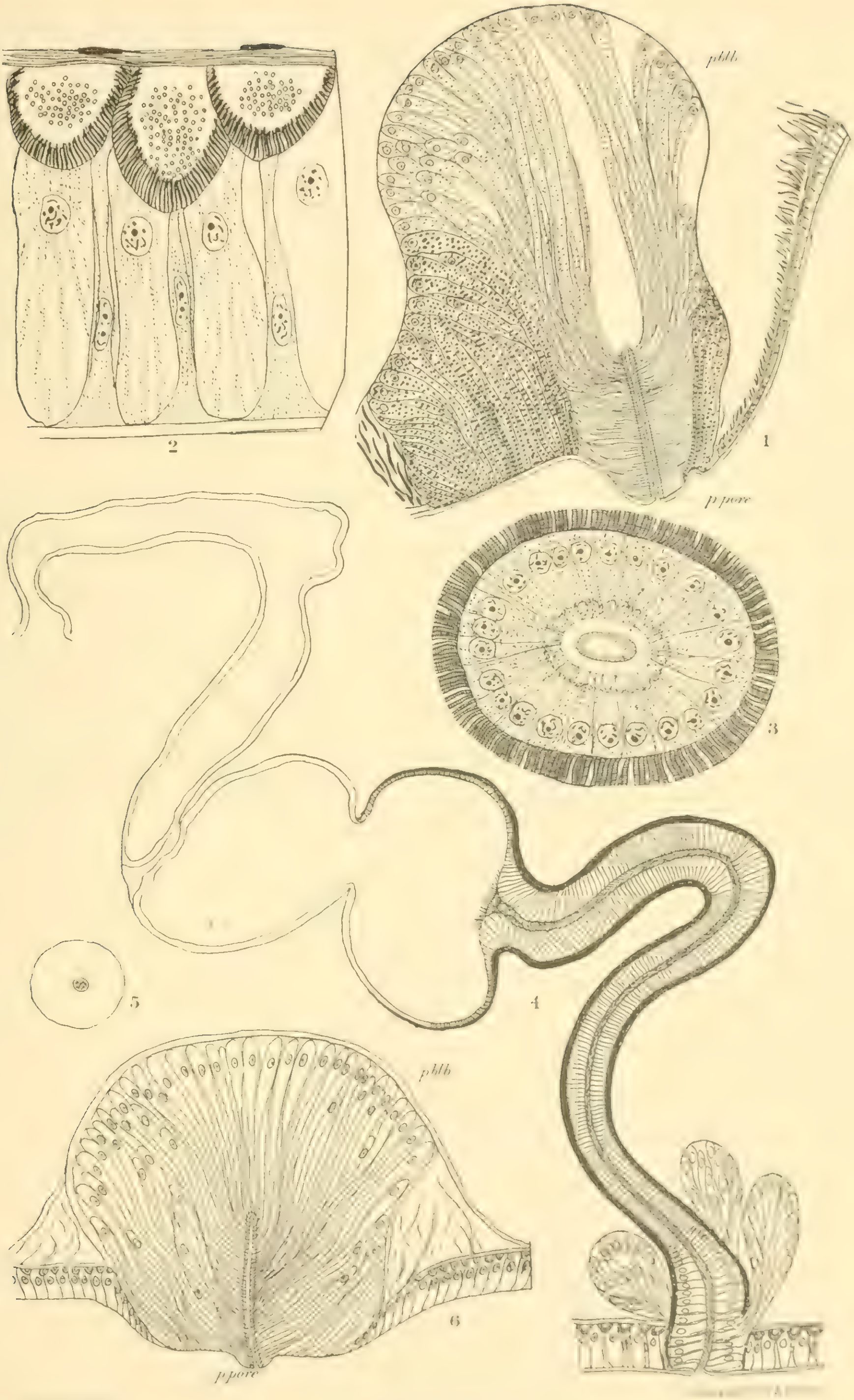
PLATE XIV.

Marionina americana sp. nov.

FIG. 1. Penial bulb. The section passes rather obliquely through one side, and accordingly does not give a correct idea of the exterior shape of the bulb. The heavy glandular cells probably open onto the exterior in the same manner as in *Marionina alaskæ*.

Marionina alaskæ sp. nov.

2. Longitudinal section of the body-wall. There are two kinds of cells in the epithelium, the narrower ones being touch-cells. The circular muscular layer is constructed on the nematode plan.
3. Section of spermatheca taken near the junction of the duct and the ampulla. The cells of the lumen are ciliated. They show a clear zone just back of the cilia, but owing to improper fixation more details cannot be given. The outer dark zone represents the longitudinal muscles.
4. Spermatheca. The figure is constructed from sections, and is accordingly only approximately correct as regards the relative size of the parts. The duct is covered with a strong layer of longitudinal muscles.
5. Lymphocyte.
6. The penial bulb in longitudinal section. There are two kinds of cells composing the glandular structure, one kind opening in the sperm-duct, the other around the pore.



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MARIONIA AMERICANA. 1

MARIONIA ALASKÆ. 2. 3.

PLATE XV.

Henlea californica sp. nov.

FIG. 1. Penial bulb. The narrower glands open close to the sperm-duct, while the wider and generally larger glands open along the base of the papilla outside of the sperm-duct. The relative difference of structure in the two sets of glands is diagrammatic. The narrower glands possess by far the finest granulation.

Henlea ehrhorni sp. nov.

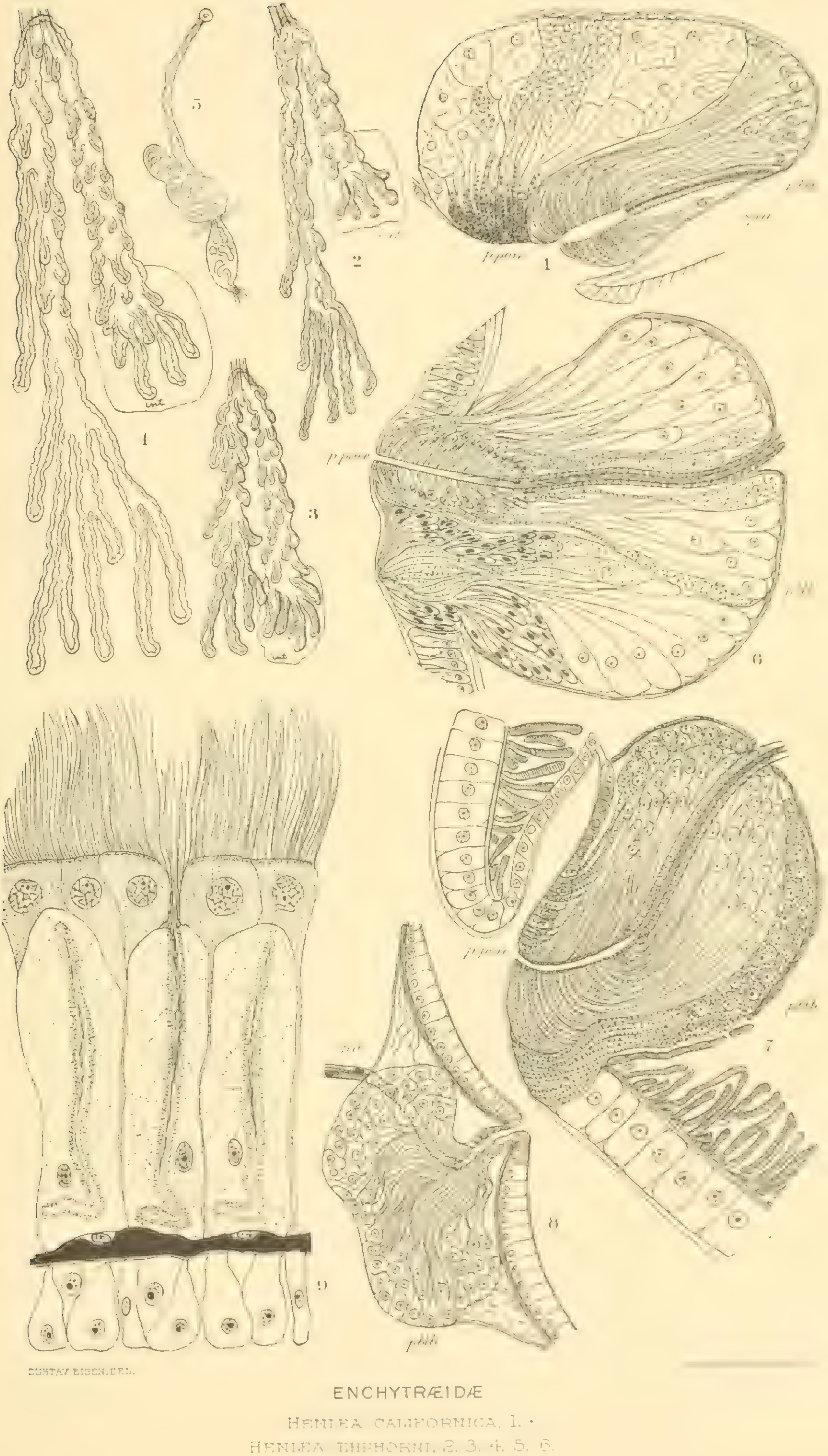
2. One of the salivary glands, dissected.
3. One of the salivary glands, dissected. The salivary glands in the specimen that was sectioned are typical, and not folded on themselves as in the dissected specimen.
4. One of the salivary glands, dissected.
5. A nephridium.
6. Penial papilla and bulb. There are four sets of glands, two sets opening into the sperm-duct, and two sets opening in or around a small pore anterior to the spermiducal pore.

Henlea guatemalæ sp. nov.

7. Penial bulb, showing the arrangement of the different glandular cells.

Fridericia californica sp. nov.

8. Section through the penial bulb. There is only one kind of unicellular glands. *spd.*, sperm-duct; *p.blb.*, penial bulb.
9. Chylus cells from the intestine, showing the interior chylus duct.



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Henlea californica, 1.
Henlea ehrhorni, 2. 3. 4. 5. 6.
Henlea guatemalæ, 7.
Fridericia californica, 8. 9.

PLATE XVI.

Fridericia sonoræ sp. nov.

FIG. 1. Penial bulb and sperm-duct.

2. Section of the intestine in one of the somites posterior to clitellum, showing three chylus cells separated by blood vessels. They are lined by an inner ciliated epithelium. On the opposite side is a row of muscular strands covered by chloragogen cells.

3. A chylus cell, showing interior canal and outer layer of ciliated epithelium. The blood is represented as black. Diagrammatic.

Fridericia santærosæ sp. nov.

4. Penial bulb, in a transverse section of the body. The bulb contains a row of unicellular glands. *p.blb.*, penial bulb ; *sp.d.*, sperm-duct ; *gl.c.*, unicellular glands inside of the bulb, which constitute the main part of the bulb.

5. Chylus cells from the intestine.

Fridericia johnsoni sp. nov.

6. A chylus cell from somite XII ; surrounded by two epithelial cells. *ep.*, epithelial cells ; *chy.*, chylus cells ; *bl.*, blood vessel ; *chlor.*, chloragogen cells.

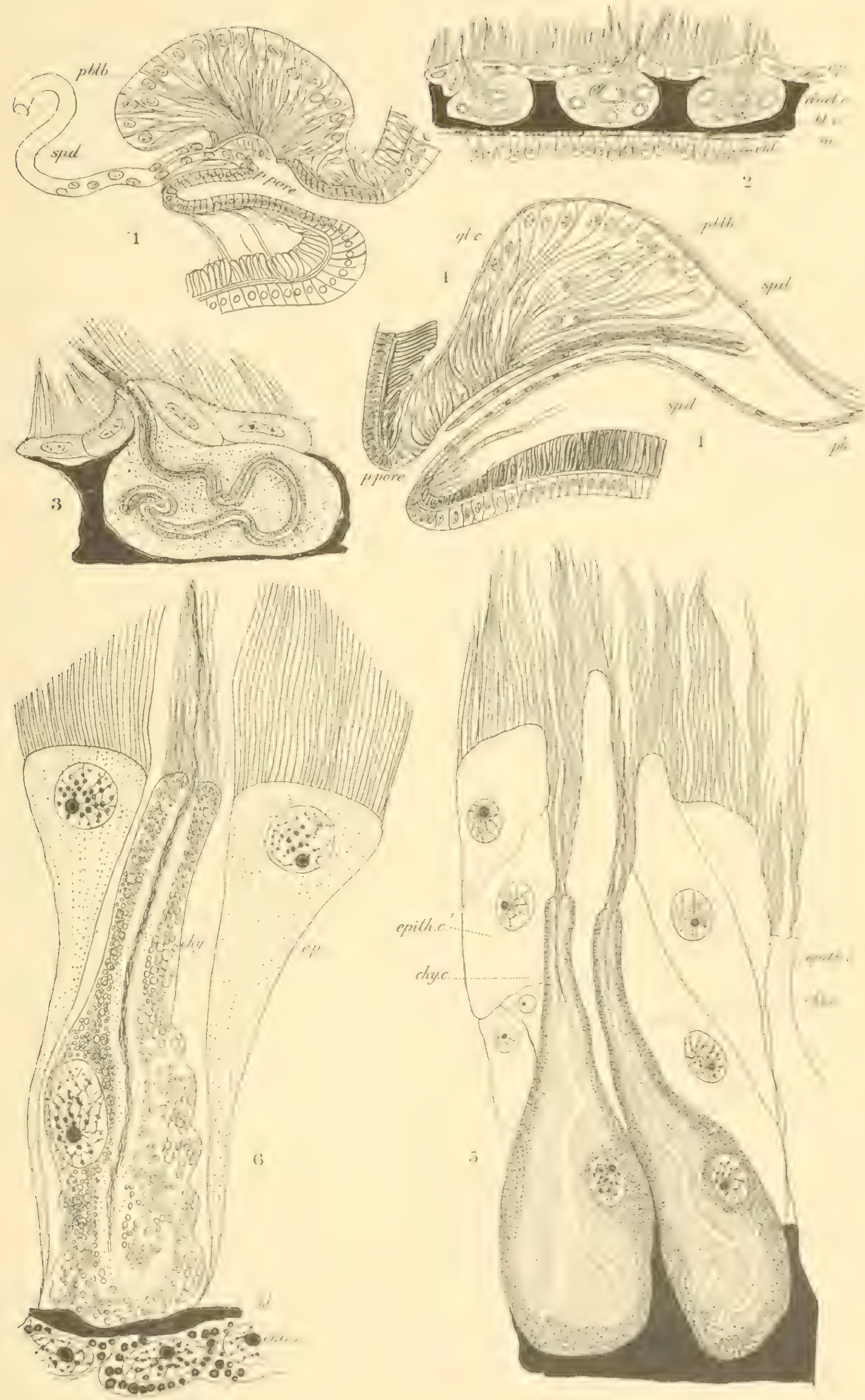

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PLATE XVII.

Fridericia fuchsi sp. nov.

Fig. 1. Longitudinal section of the body-wall, showing the deltoid arrangement of the circular muscular layer. The striated cytoplasm of the large epithelial cells is only indicated.

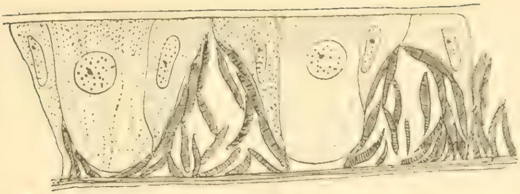
2. Section through the intestine, showing chylus cells and flat and long epithelial cells. Also interstitial cells with large round nuclei.

3. A chylus cell and epithelial cells, from the intestine, more highly magnified than in the last figure.

Fridericia macgregori sp. nov.

4. Set of chylus cells from the intestine.

5. One of the chylus cells more magnified.



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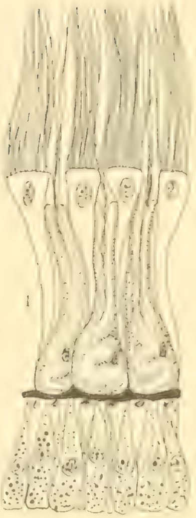

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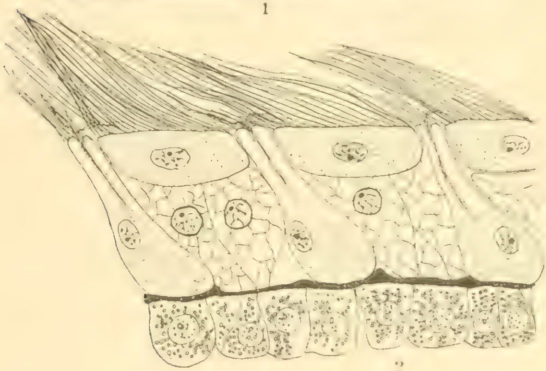

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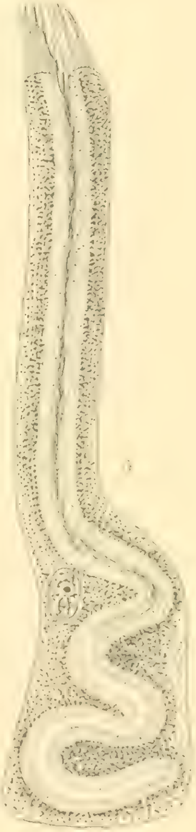

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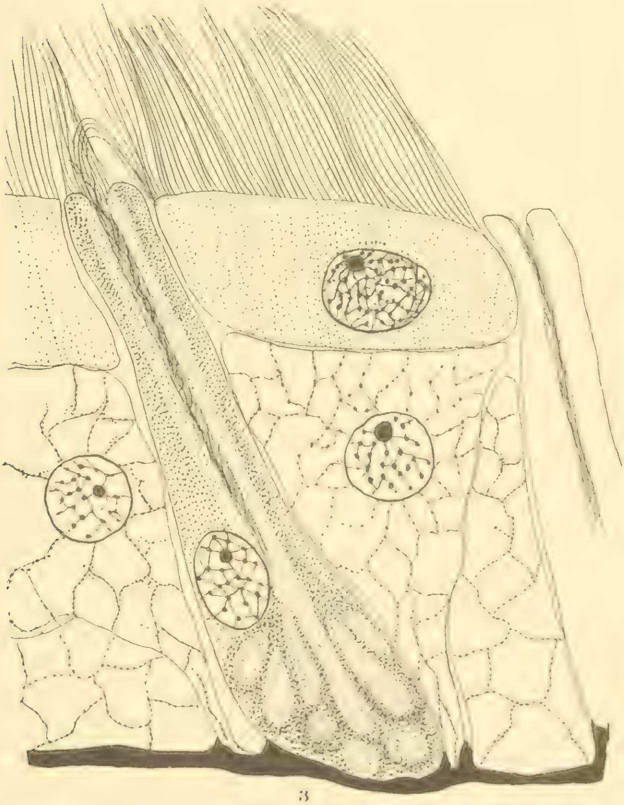

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PLATE XVIII.

Lumbricillus annulatus sp. nov.

FIG. 1. Section through the penial bulb.

Enchytræus kincaidi sp. nov.

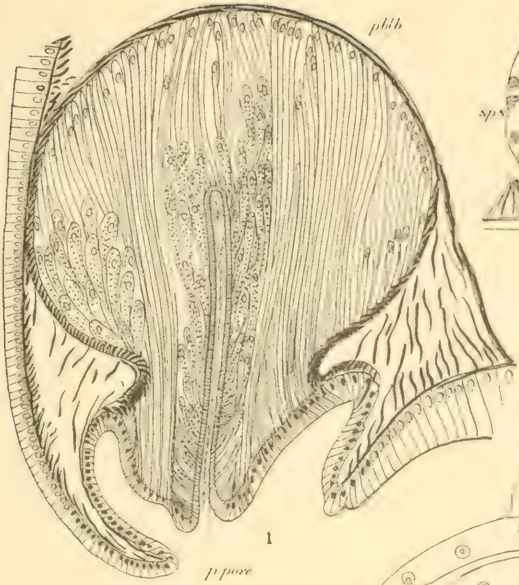
2. Testis and sperm-sac, the latter projecting into somite x.
3. Nephridium. It is composed of at least 30 cells.
4. Sexual bulbs with their papillæ, from longitudinal section of the body. The smaller complex is the anterior one.

Enchytræus metlakatlensis sp. nov.

5. Nephridium.

Enchytræus saxicola sp. nov.

6. Nephridium.



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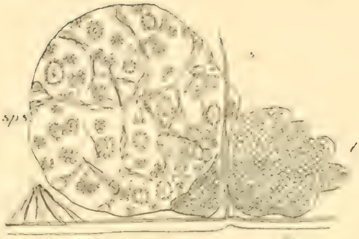

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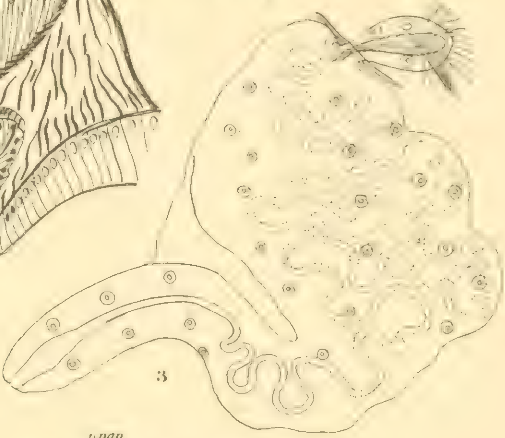

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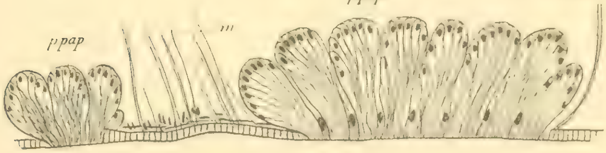

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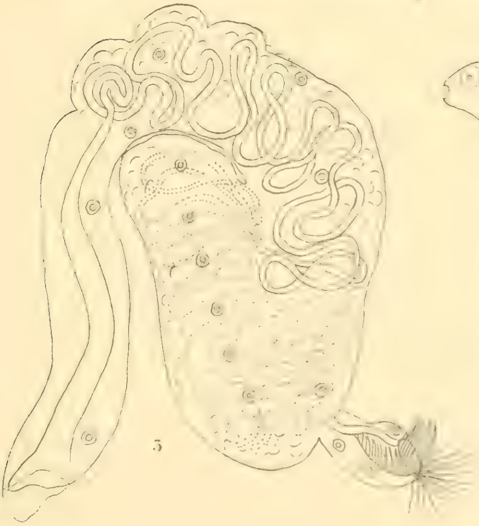

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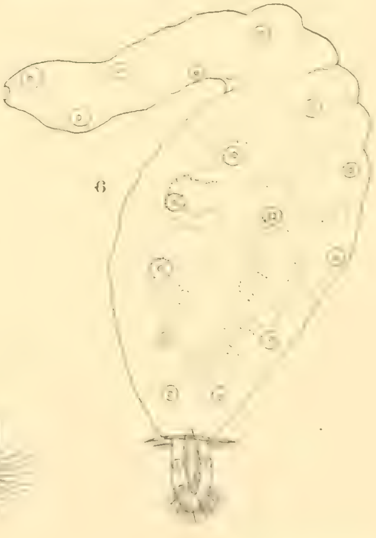

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BRICILLUS ANNULA

RÆUS KINCAIDI, 2. 3. 4.

ENCHYTRÆUS METLAHKATLENSIS, 5.

NCHYTRÆUS SAXICOLA, 6

PLATE XIX.

Enchytræus metlakatlensis sp. nov.

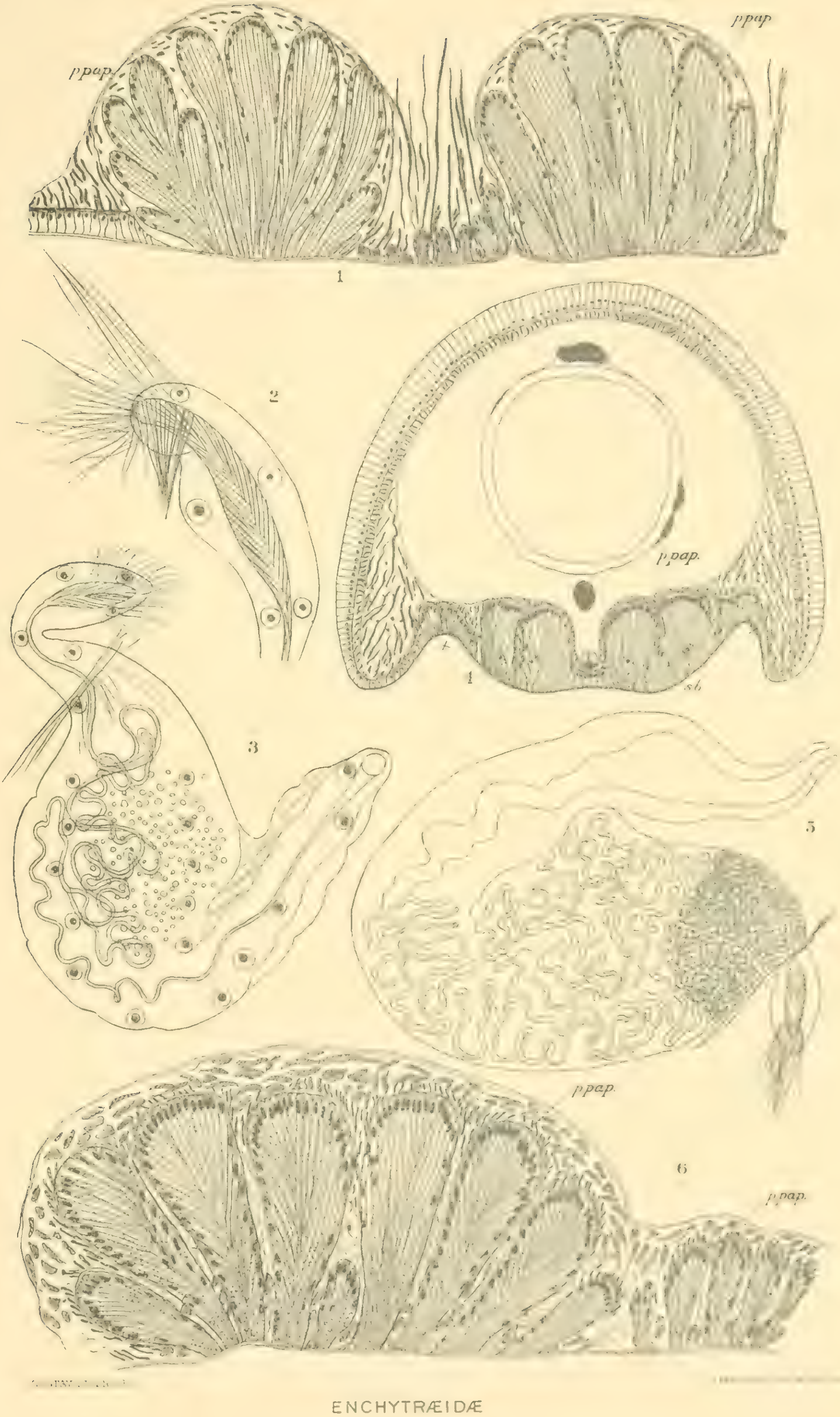
Fig. 1. Longitudinal section of penial glands and papillæ. The sperm-ducts open between the two glandular accumulations.

Enchytræus modestus sp. nov.

2. Nephrostome of a nephridium, higher magnification than fig. 3.
3. Nephridium.

Enchytræus alaskæ sp. nov.

4. Cross-section of body just behind the male-pores, showing the sexual papillæ on both sides of the ventral ganglion. In sections more forward the male-pores would lie in line with the points marked *x*. The dorsal vessel although rising in *xv* has not yet separated itself from the intestine.
5. Nephridium. The anterior part of the main body is strongly granular.
6. Longitudinal section of the ventral part of the body wall passing through the penial papillæ. There are eight or nine bunches of glands opening on the surface of the body. The penial papilla lies to the right of this papilla.



ENCHYTRÆIDÆ

ENCHYTRÆUS METLAHKATLENSIS, 1.
ENCHYTRÆUS MODESTUS, 2, 3.
ENCHYTRÆUS ALASKÆ, 4, 5, 6.

PLATE XX.

Enchytræus alaskæ sp. nov.

FIG. 1. Transverse section of the body-wall passing through the male-pore and the penial papillæ. As will be seen, there are no glands opening into the sperm-duct.

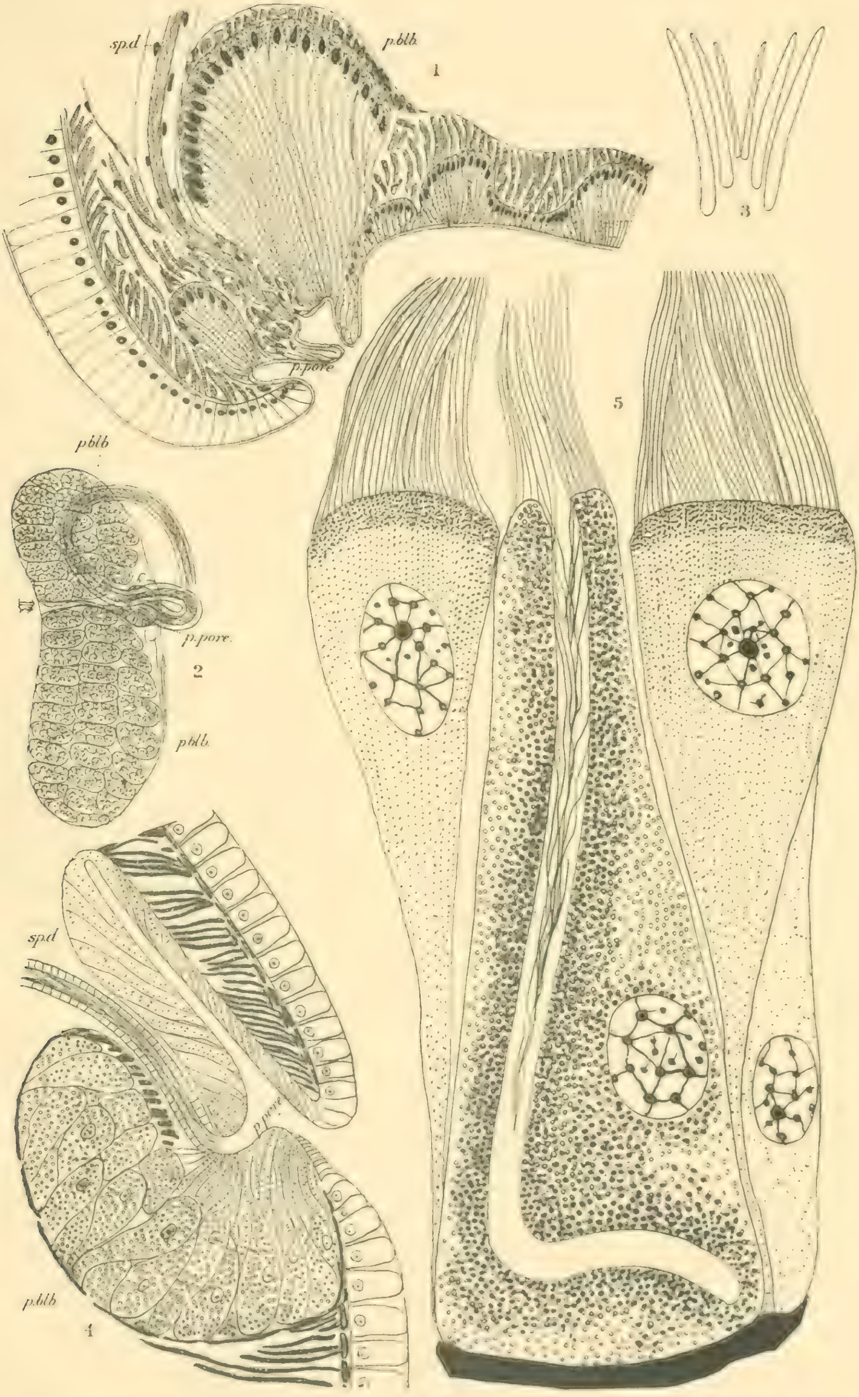
2. Spermiducal pore, sperm-duct, and two penial papillæ.

Fridericia harrimani sp. nov.

3. Setæ fascicle from ventral side.

4. Section of penial bulb, from a transverse section of the body. Showing that the sperm-duct enters the bulb on one side and nearer the base than in most other varieties. There are two kinds of cells, some of which open into the lower part of the sperm-duct, while others open on the free outer surface of the bulb.

5. Section of the intestine in somite XIII, showing the chylus cell surrounded by two epithelial cells and an interstitial cell. The chylus canal is lined by a distinct membrane, the upper part of which is ciliated. At the base of the chylus cell is a blood sinus.



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ENCHYTRÆIDÆ

ENCHYTRÆUS ALASKÆ, 1, 2.
FRIDERICIA HARRIMANI, 3, 4, 5.

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